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AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 15, NO. 23. WEEKLY. | NEW YORK, THURSDAY, JUNE 9, 1892. | $3.00 per Annum. SINGLE COPIES 6 CENTS.

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Brown & Sharpe No. 8 Plain Milling Machine.

The milling machine shown herewith is adapted for a larger and heavier class of work than the other machines of a similar type made by the same firm, having cones for wider belts, larger spindle, heavier table and saddle, and more powerful feed.

The front bearing of spindle is $3\frac{3}{4}$ inches diameter and $5\frac{3}{4}$ inches long, the rear bearing being $2\frac{1}{2}$ inches diameter and 5 inches in length. Besides the taper hole for the arbor, the spindle has a recess across the end, so that by means of a cap nut an arbor having a clutch collar can be positively locked for driving the cutters. The spindle runs in bronze boxes, which are tapered and provided with means of compensation for wear.

The table is 66 inches in length, 16 inches in width, has a working surface 54 inches long and a bearing in the saddle of 40 inches. Three T-slots extend the entire length between the pans at end. It may be lowered a distance of $19\frac{1}{2}$ inches below the center of spindle, has automatic feed of 48 inches and adjustment in line with spindle of $9\frac{3}{4}$ inches. Milling may be done at a distance of 21 inches from the face of column, and cutters up to 16 inches diameter may be used.

The three-step cone is made for a $4\frac{1}{2}$-inch belt, the largest step being $13\frac{3}{4}$ inches diameter. The back gearing is $8\frac{1}{3}$ to 1, which, with the two speeds on countershaft, provides for twelve speeds for spindle.

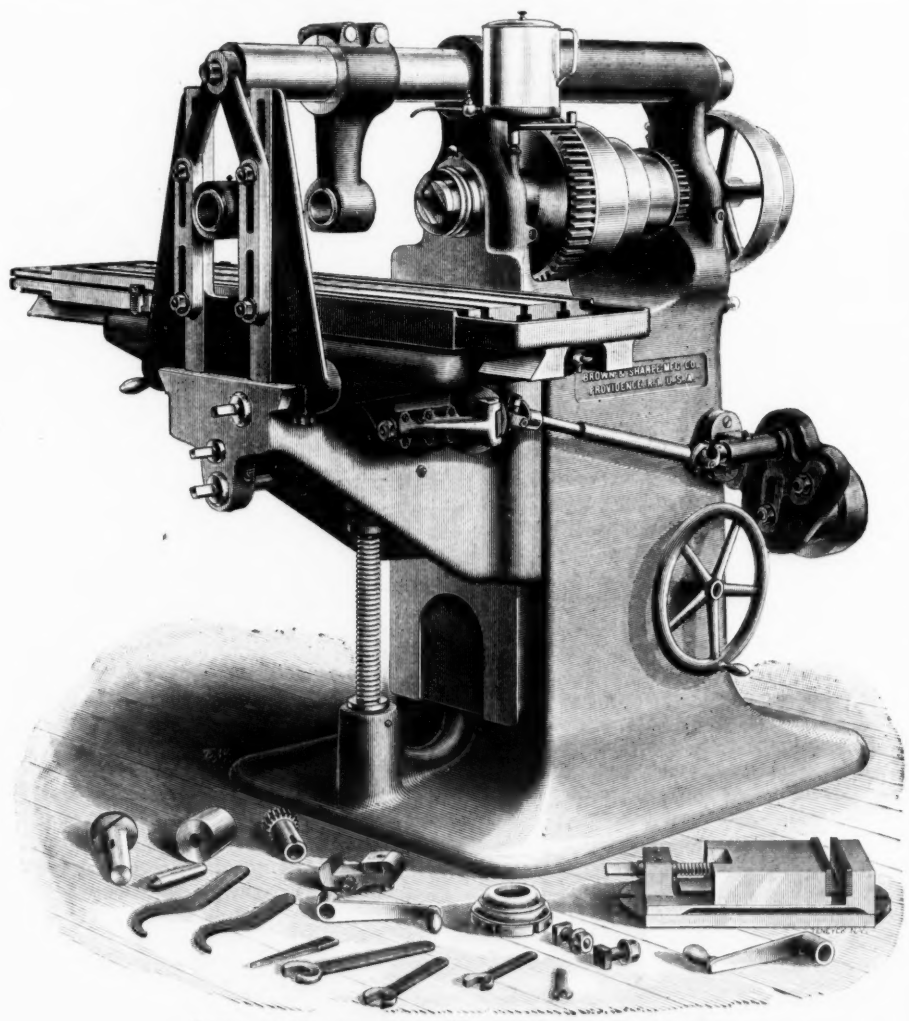
The feed cones have two steps, and by transposing them and changing the feed gears, eight changes of feed, ranging from .02 to .25 inch per revolution of spindle, may be had in either direction.

The overhanging arm, which is of steel, is $4\frac{3}{4}$ inches in diameter, and may be rigidly connected to the knee by an improved arm brace, which is readily adjustable, and has a bearing for the outer end of the arbor, thus allowing the usual arbor support to be used at any intermediate point, as near the cutter, counteracting the tendency of the arbor to spring under heavy cuts.

The vise has jaws $7\frac{1}{8}$ inches wide and $1\frac{7}{8}$ inches deep, which may be opened $4\frac{1}{2}$ inches.

The overhead works have two sets of tight and loose pulleys, 16 inches and 20 inches diameter, for 5-inch belt; speed of countershaft, 112 and 140 revolutions per minute.

The weight of machine, ready for shipping, is about 5,000 pounds; the floor space required is $68\frac{1}{2}$ inches by $114\frac{1}{2}$ inches. The manufacturers are Brown & Sharpe Mfg. Co., Providence, R. I.



BROWN & SHARPE NO. 8 PLAIN MILLING MACHINE.

Chemistry in the Foundry.

BY PROFESSOR JOSEPH TORREY.

II.

The great difficulty with the solution of the many problems connected with iron by chemical analysis, is that outside of certain every-day and very general relations (which are so general, by the way, as to really lead to very little), there is not much that is definite known as to the actual influence of the impurities in iron on its quality. I think I speak advisedly on this point. My experience has been fairly wide and instructive. I have many times conducted and directed research work on problems of this nature, and the time was when I expected definite results, but that time is no longer, for the results never came.

For instance, I once thought I would make tests of a number of samples of cast-iron (for transverse strength), making chemical analyses and plotting the results. I had the good natured co-operation of an accommodating manufacturing firm, and the foundry foreman was a very well informed and careful man. The samples were bars one foot long and one square inch cross-section. They were cast under as uniform conditions as possible, but from iron of quite different strength and hardness. In each case the transverse breaking test was first made, then careful determinations were made of carbon (graphitic and combined), silicon, sulphur, phosphor, and manganese. There were about thirty samples in all, and the results, if I had them at hand now, would be very instructive indeed. To make a long story short, the analyses were perfectly worthless when brought into comparison with the breaking tests. They gave simply no information that could not have been obtained with much less labor by an examination of the fracture.

I do not say that there was no relation between the analysis and the strength test, but what I do mean is that the indications were too obscure and too complicated to be of any commercial use. I believe, moreover, that this experience could be duplicated by many others who have worked in the same field, and I think the general fact is that close study, instead of revealing simpler relations between the chemistry and physics of iron, has worked decidedly in the opposite direction, and has revealed additional complications and interdependencies.

It may be said that the most of what has been said so far applies to steel and "wrought-iron," but not to cast iron. I have never seen any reason to believe that the problem was notably different in case of cast-iron from what it is in case of wrought-iron and steel. In both cases the question, reduced to its simplest form, is not a practical question, and if it be put in a practical form it is difficult enough of solution to terrify the boldest. Suppose, for instance, you take a sample of cast-iron. The question is, "Can we tell from an analysis of this iron whether it will prove a strong iron?" Perhaps we can tell what the strength of the iron will be, but can we tell what the strength of *a piece of it* is? I know this will seem a fine distinction, but still it is a part of the history of engineering constructive science that the tables of ultimate strengths of timber were for many years based on tests made on small test pieces of smooth, sound, straight-grained wood. The tests gave the strength of say typical pine wood, but they gave only the wildest and vaguest approximation to the actual strength of pine beams, such as the engineer could procure for his structures. Nor is this surprising. It is exactly what was to be expected, but, nevertheless, engineers contented themselves with these erroneous results and conclusions for years. The case is certainly as bad in the instance of cast-iron. A test made on a piece of cast iron one foot long, say, and one square inch cross-section, tells very little about the strength in the casting. The fracture will tell that. Compare the fracture of such a bar with that of a column of say 30 square inches cross-section cast from the same iron, from the same cupola, and from the same charge, same ladleful too, if you will, and the fractures will tell a story of different strengths which tests will confirm. These again are familiar facts known to every foundryman. I only mention them to emphasize my point, namely, that our test piece system of discussing the question is too ideal and vague. *Typical* iron of a certain chemical composition has undoubtedly a certain characteristic set of physical properties, but what of it? If test pieces could be cast from this iron in different parts of the country under precisely identical conditions in every way from the time the cupola was picked out till the casting was cool—*absolutely* identical conditions in every little detail—then the test pieces would, *perhaps*, test alike. I am not perfectly sure they would. But under what conceivable conditions could one make use of such knowledge?

Now the question raised by Mr. Bolland is whether foundrymen cannot determine the best methods of mixing given brands of iron so as to produce castings having certain qualities by means of chemical analysis. I doubt it very much; that is, I doubt whether it is a step forward from a business point of view. I think it would be a good thing if foundries the country over would install chemists and erect laboratories. It would give a great impetus to the study of cast-iron, but I think science, for some time at least, would get the lion's share. Moreover, the results would differ greatly in different foundries. It takes the skilled metallurgical engineer to reason from the chemistry to the physics of iron. The chemist must be a good one if results are to be good for anything; the expense will not be trifling, and, on the whole, will it pay?

I have no intention of trying to instruct Mr. Bolland or any other foundryman. I have simply called to mind a number of facts with which they are presumably as well acquainted as I am; better, perhaps, with one side. The only object in so doing is to put the question of chemistry in the foundry in its proper light with relation to existing facts. Perhaps the foundry at large, *from a business point of view*, would be benefited by the co-operation of the chemical laboratory, but I do not as yet believe it.

One word more. Most things that amount to anything in this world are at some period of their history run into the ground. Chemistry in manufacturing establishments is no exception. There is no question as to the great benefit that has resulted from its introduction in the steel and iron, paper pulp, dyeing, and numerous other industries, but it has very certain and well-defined limitations in its application.

The foundry has not the great train of waste and by-products that many industries

have, and the waste, such as it is, can be better controlled. The one place where it would seem that chemistry might come in would be in the mixing of irons, as Mr. Bolland suggests, but, as previously stated, it is by no means certain that anything definite or satisfactory would be accomplished.

No. 3 Variety Saw.

The illustration herewith represents a machine recently brought out by the Egan Company, 239–259 Front street, Cincinnati, O. It is used for the purpose of ripping, cross-cutting, beveling, cropping, grooving, mitering, boring, etc.

The machine is self-contained and is made entirely of iron and steel, the frame being a cored pedestal carrying the countershaft. The cast-iron table is ribbed and braced, to secure strength, and can be plumb, at right angles with the saw or adjusted to any bevel up to forty-five degrees. It is guided in raising or lowering by gibbed ways, with adjustment for wear.

The mandrel is of cast-steel and runs in self-oiling boxes.

The fences can be used on either side of the saw, giving the operator the advantage of such construction, which is especially advantageous when using the table on a bevel.

As a boring machine it has an independent adjustable table, which can be raised and lowered by a screw operated by the wrench handle shown on the boring side.

One man can work on the saw side without interfering with an operator on the boring side, who has all the adjustments at hand for boring, routing, and similar work.

This machine is designed for use in woodworking shops generally, and is, it is claimed, excellently adapted for the use of pattern makers, owing to its quick means of adjustment.

The Measurement of Curved Lines.

BY FREDERIC R. HONEY.

The formula for Huygens' approximation to the length of a circular arc should find a place in the engineers' note book. It is very easily remembered and applied.

Let A, Fig. 1, represent the length of the chord of the arc, and let a represent the length of the chord of half the arc; the length of the arc $L = \frac{8a - A}{3}$.

Prof. Williamson shows* that when the arc subtends an angle of 30°, the radius being 100,000 feet (nearly 19 miles) the error by this formula is about two inches, or $\frac{1}{600000}$ part of the radius. This measurement is *practically* exact.

Prof. Williamson also shows that when the length of the arc is equal to the radius, *i.e.*, when it subtends an angle of 57°.3, the error is less than $\frac{1}{7680}$ part of the radius. Therefore if the radius is 100,000 feet the error is less than $\frac{100000}{7680} = 13$ feet. Even this is very small in comparison with the length of the curve.

We see from these examples how rapidly the error increases with the increase of the angle subtended.

If we apply the formula to the measurement of an arc which is described with a short radius, we find that the error is so small that it may be neglected. Describing an arc with a radius of 12 inches *subtending an angle of* 30°, *the error is* $\frac{12''}{600,000} = \frac{1''}{50,000}$ — one fifty thousandth of an inch. For 57° 3 the error is less than $\frac{12''}{7,680} = 0''.0015$, *i. e.*, between one and two thousandths of an inch.

In order to measure an arc—Fig. 2—when it subtends a larger angle bisect it and measure each half as before, in this case making B = length of the chord of half the arc, and b = length of the chord of one-fourth the arc; then $L = \frac{16b - 2B}{3}$.

* See Differential Calculus. Benj. Williamson, page 66 *seq.*

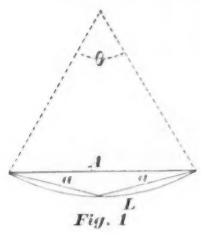


Fig. 1

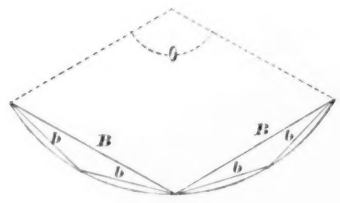


Fig. 2.

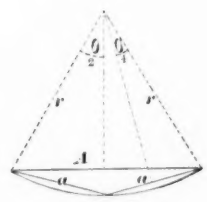


Fig. 3.

THE MEASUREMENT OF CURVED LINES.

The formula may evidently be adjusted to any case which may arise, the degree of accuracy sought being dependent upon the character of the work.

The accuracy of the formula may be tested as follows: For an arc subtending any angle θ, calling the radius r:

Fig 3. $$a = 2\,r\,sin.\,\frac{\theta}{4}.$$

$$A = 2\,r\,sin.\,\frac{\theta}{2}.$$

Therefore

$$\frac{8\,a - A}{3} = \frac{16\,r\,sin.\,\frac{\theta}{4} - 2\,\,r\,sin.\,\frac{\theta}{2}}{3} = \frac{2\,r}{3}\left(8\,sin.\,\frac{\theta}{4} - sin\,\frac{\theta}{2}\right) \quad [I.]$$

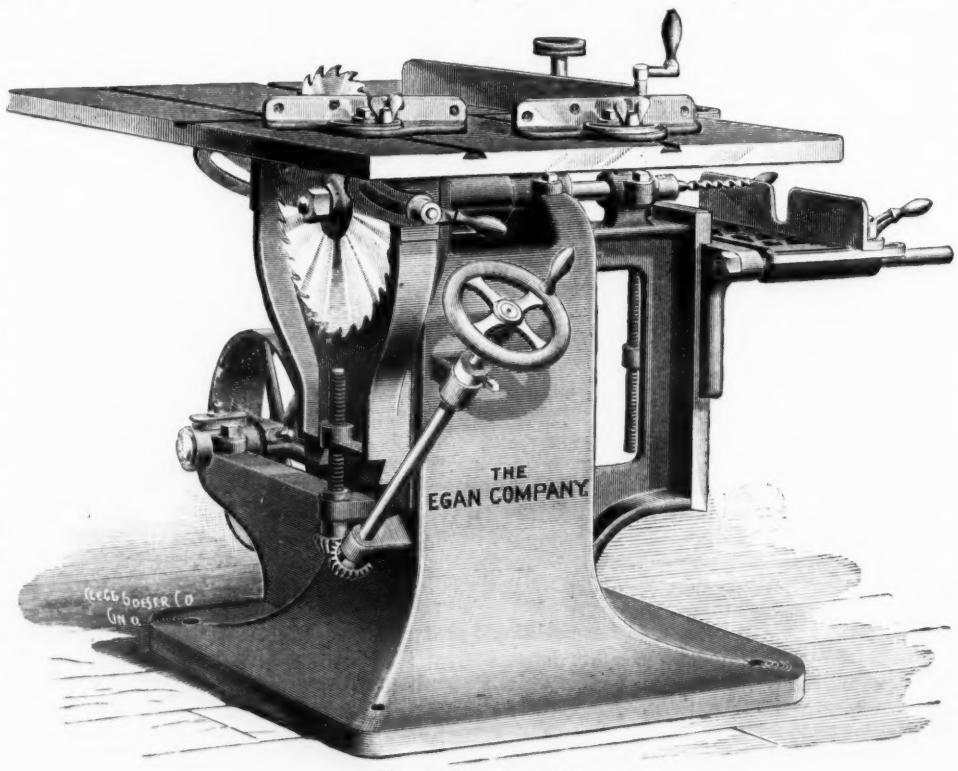
The true length of the arc is equal to

$$\frac{2\,\pi\,r\,\theta}{360} \quad [II.]$$

The difference between [I.] and [II.] gives the error in terms of the radius.

Any curve may be measured by assuming points upon it at short equal distances apart.

The length of an arc of a circle passed through three of these consecutive points will give approximately the length of a part of the curve. The sum of partial measurements thus made will be the total length of the curve.



NO. 3 VARIETY SAW.

Utilization of Water Supply—Electric Transmission.

BY W. H. BOOTH.

That much power is often run needlessly to waste has been rather curiously exemplified in England of late. It appears that in the small city of Truro, a place of about 11,000 inhabitants, certain of the streets have open channels of water running down by the sidewalks similar to what may be seen in Cambridge and Cape Town, and indeed many other places.

These channels had got into a serious state of disrepair, and the corporate funds were wanting with which to effect same without levying an additional, and, of course, objectionable rate, when a local baker stepped into the breach and offered to repair the channels at his own cost if he could have the use of the water they discharged.

With an alacrity not often seen in a city corporation, the offer was closed with on the spot, and the baker, who had contrived to put himself in funds, forthwith did what he had engaged to do like an honorable man; but he did more than this, for his store being situated in a low-lying part of the town, he put an undershot wheel into his cellar, fitted up a battery of secondary cells or accumulators, hitched a dynamo onto the undershot, and his bakery was illuminated by the electric light.

He now proceeded to offer to light up his neighbors for the cost of their year's gas bills, the said neighbors getting the benefit of better light and no sulphur, and he is now lighting quite a little district, and the city authorities are looking for flaws—in the electric mains?—no! in their agreement; and are watching all their unappropriated drains or water pipes as if they anticipated their forcible seizure by the butcher.

The Southeastern Railway Co. of England has bought a lot of American car bodies and put them onto English trucks, and is running them as a train. This company is chiefly noted in England as having about the oldest cars in the land, many of them being of a pattern which has not been built for forty or fifty years.

Needless to remark that even those who object to the open style of car are glad to welcome anything new on the Southeastern. Even a new "president" of the line would be preferable to the present one, or totally new board of directors.

In going over to the Continent from England Americans usually find themselves or think themselves compelled to go either *via* Dover or some other port served by the worst two railroads in England. A far better way, and one which enables the traveler to see Holland and Belgium, two countries of special interest to engineers, is that by the Great Eastern Railway from Liverpool street *via* Harwich to Antwerp or Rotterdam. The steamers on this route are good, electrically lighted, and one can leave London at 8 P. M. and breakfast in Antwerp or Rotterdam early next day, and if needful take an early train.

In Holland those interested in sea works, canals, drainage works and hydraulic engineering or bridges generally will see more in a limited area and time than they could see in any other country, while Belgium is full of interest to mechanical men.

Though the factory system of manufacture must generally be workable at less cost than that of home manufacture, there may be cases where home industries can be made to pay better than factory work. If there are such cases undoubtedly the use of electricity as a motive power will be an immense aid. It is reported that at St. Etienne, the center of the French ribbon trade, there are as many as 18,000 ribbon looms in the workers' houses, and not above 5,000 looms steam-driven on the factory system. Now with an unlimited water power, electricity is being generated by dynamos, and is to be provided at a charge of seven cents per loom per day. The advantages claimed are the saving of cost of factory, and of the time required for workers to go to and from their work. The production of a ribbon loom is also so small in weight that there is not a difficulty in the worker carrying to and fro his materials and finished product perhaps but once weekly.

Where a cheap motive power can be thus supplied for home industries of a light sort there seems no reason against the success of the method when the weight of the manufactured article is small. The watch industry seems to be one which could be thus worked to a very considerable extent, as the weight of a few thousands of small wheels, etc, is but small, and the running of a watch lathe by an electric motor would not be, by any means, an annoyance in a house.

In the old days of hand loom weaving in England it was usual to build a roomy top floor to a dwelling house, and I can remember when a child to have heard the click of a hand loom of one of the still surviving hand loom weavers in such a house. They have all gone now, but I question if they would have disappeared if it had been as easy to divide steam power or distribute it as it is electrical power.

The most serious limitation to the possibility of home industries will be apparent to any one who thinks of the matter as that of cost of machinery which may be almost compulsorily idle when its attendant is sick or otherwise off work. Still the time now spent in going to and from home must, with the sickness due to exposure in all weathers, tend to add to the expenses of a costly factory.

The first result of Mr. Tesla's lectures and experiments with high tension electricity is the alarm of the electrical engineers at finding that against high tension currents the substances hitherto looked upon as insulators are comparatively useless.

Some experiments with a 75,000 volt current have been made on glass, ebonite, oil, and other accredited insulators, with the result that even with 40,000 or 50,000 volts there would be creeping discharges over the surface of any of them unless kept absolutely clean and dry—a manifest impossibility in practice.

It was shown that oil containing dust in suspension was rendered useless as an insulating medium, because the dust acted like stepping stones for the current—dividing the thickness of the insulation into sections which could be jumped by the current.

With the smallest crack in a rubber coating a foot thick upon a conductor, a current of 40,000 volts was considered to be able to leak.

A piece of thin wood yielded peculiar results, and seemed to be built up of a large number of different sections of varying degrees of conductivity. First a non-conductor; as the voltage was increased its surface became covered with points of light as of a number of small arcs, and these increased with the current until finally the whole block of wood burst into flame. Nothing seemed so good as an insulating material as oil, free, of course, from solid suspended particles.

The "Putnam" Bolt Cutter.

We present on this page an illustration of a bolt cutting machine designed to cut bolts from ⅜" to 1¼" diameter. The machine has a hollow spindle, so that it will admit bolt rods of any length. Four cutting dies are used, which open either automatically or by hand, as may be desired. The dies admit of adjustment to size, an index showing the size cut. One passage of the dies over the bolt completes it.

At Fig. 2 we give a partial section of the machine, showing the spindle, the head at the right, and below this the mechanism for automatically opening the dies.

On the spindle, and revolving with it, but free to move endwise, is a sleeve *S*, which is driven by two feathers placed diametrically opposite each other as shown. This sleeve is moved endwise by a ring which is fitted to the square groove near the back end, this ring being moved by means of the hand lever seen in the perspective engravings. Near the forward end of the enlarged portion of the sleeve *S* there are two rollers *r r*, which revolve freely on fixed studs and engage with spiral or cam grooves cut in the periphery of the cam *C* shown in Figs. 2 and 3. This cam is also journaled upon the spindle, and, by the movement of the rollers *r* backward or forward, is made to revolve upon the spindle, and thus by the four cam tracks cut upon its face, as shown in Fig. 3, opens or closes the dies.

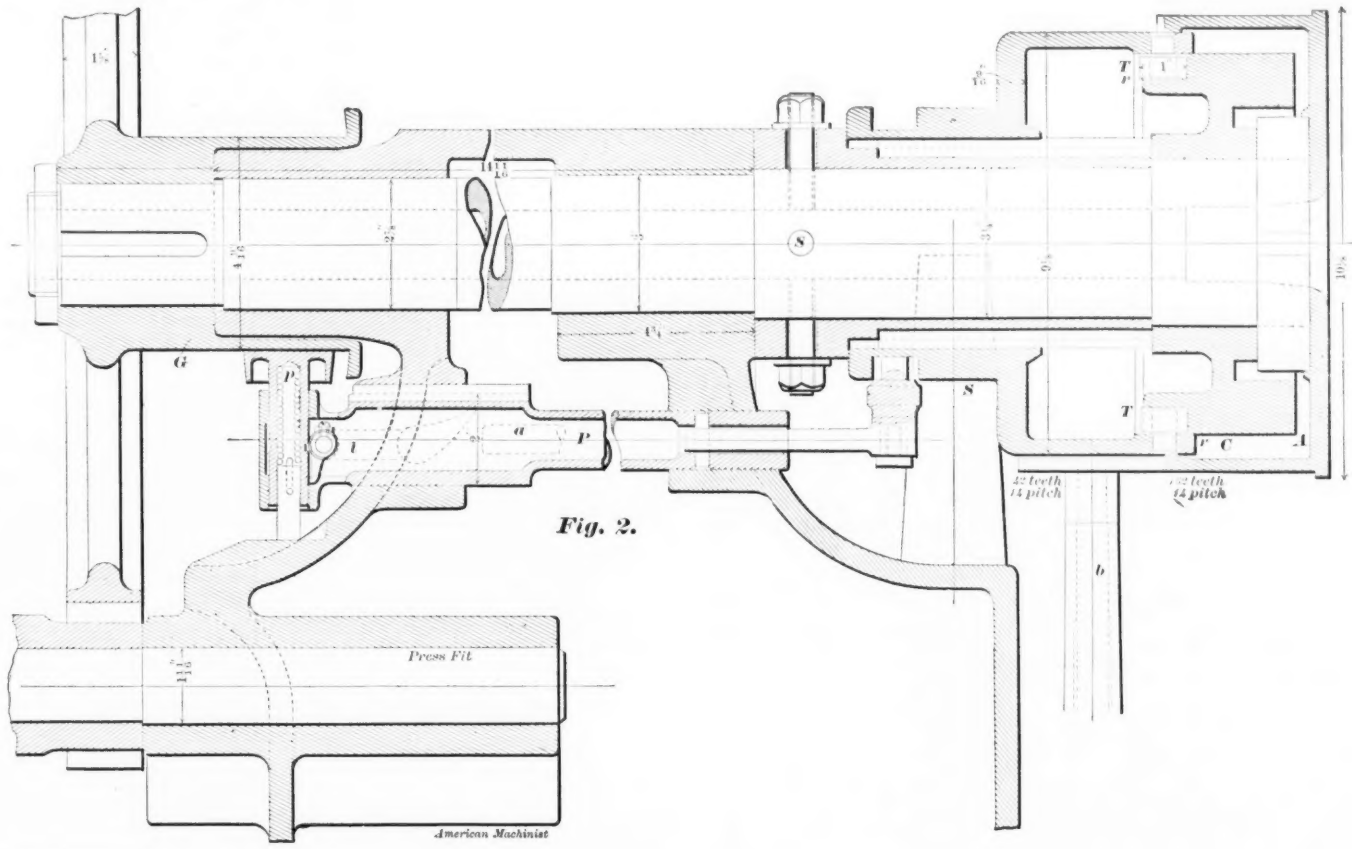
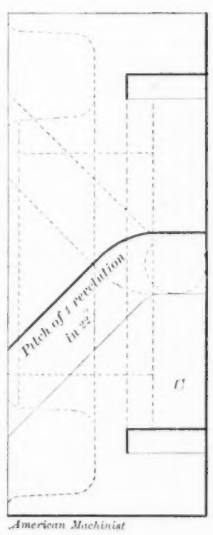


Fig. 2.



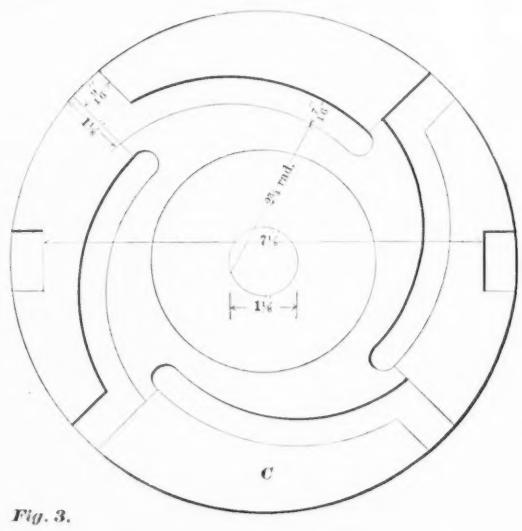


Fig. 3.

Below the spindle there is a plunger *P* (Figs. 2 and 4), which at its right hand extremity is connected to the hand-lever and shown, but on the hub of the main driving gear *G* there are two cams which force it down sufficiently so that the latch *l* catches in the groove turned in the shank of *p* and holds it down, after which it is not affected by any of the cams upon the hub of the gear. The latch *l* is supported in the bearing formed in the lateral extension of *P* shown in Fig. 4, and is of such form that when the rod *a*, Fig. 2, which is shown in front of the head at the right of the perspective engraving, comes into contact with it, the outer end is pushed upward and the latch thus disengaged from the notch in *p*, which immediately springs upward so that it is acted upon by a cam which is upon the hub of the gear *G*, and which forces *p*, *P* and the sleeve *S* backward, opening the dies in the same manner as if done by hand. Another cam, before referred to, again forces the plunger *p* downward to its place and, the rod *a* being withdrawn, the latch *l* again holds *p* out of contact with the cams. The rod *a* is moved by the carriage as shown, being threaded and provided with adjustable nuts which cause the opening and release of bolt to take place at any desired point.

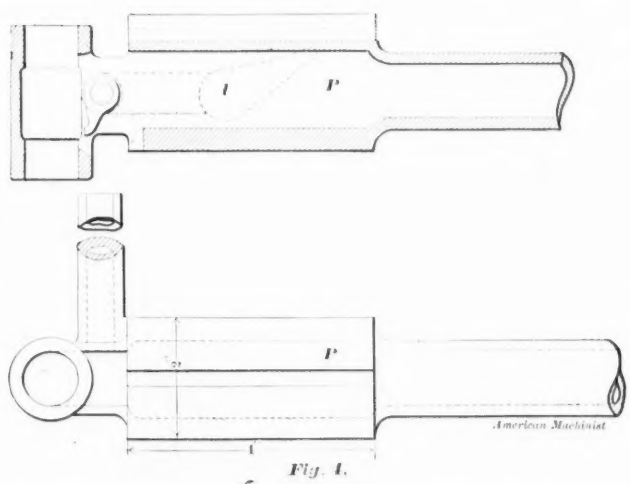
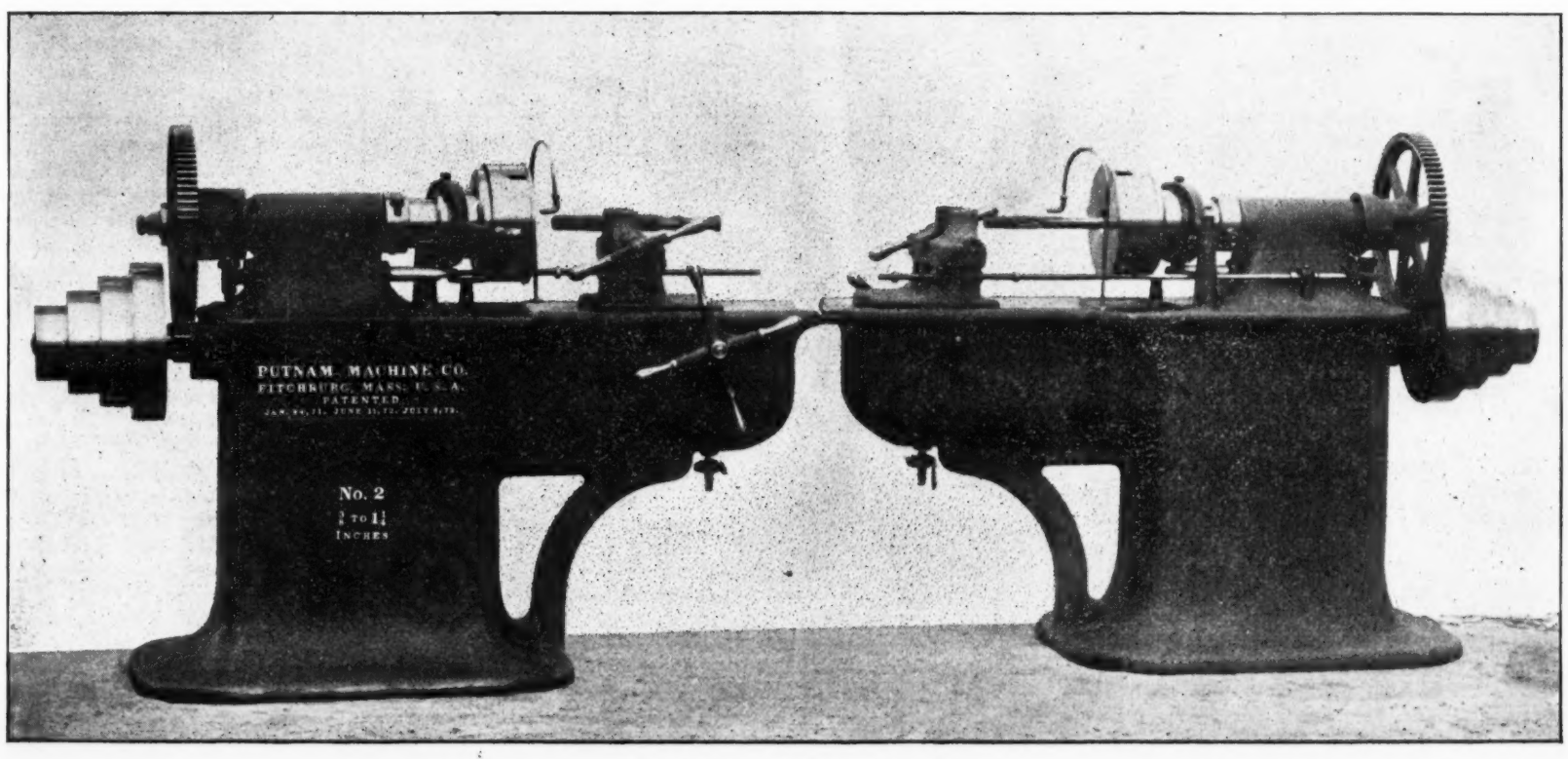


Fig. 4.

It is thus seen that the machine is always ready to have the dies open automatically or by hand, as may be preferred, without any changes being necessary in the arrangement of any part.



THE "PUTNAM" BOLT CUTTER.

Over the front portion of the head a cap is fitted, which at the back edge is provided with gear teeth which drive a pinion on the upper end of shaft *p*, this shaft driving the pump which supplies oil in abundance to the dies.

The dies are so made that they can be sharpened by grinding on their cutting faces, an ordinary grindstone or emery wheel being available for this purpose.

The machine can be arranged for cutting left hand bolts by a simple change of dies, and nuts can be tapped with it also, either right or left-hand. The engraving shows that the machine is neatly and substantially designed, simplicity and non-liability to derangement having been especially kept in view in its construction. It is made by the Putnam Machine Co., Fitchburg, Mass.

The Renshaw Ratchet Drill.

The engraving shows this drill with various attachments, as made by the Pratt & Whitney Co., Hartford, Conn. In its general features this drill is favorably known to mechanics, and the various attachments have been added for the purpose of giving it a wider range of usefulness.

The adjustable friction feed adds to the completeness of the tool. In operation it is only necessary to vary the friction by the clamping screw to suit the sized drill being used and the character of the work.

The extension feed screw is more especially designed for the use of boiler makers. It has a long knurled shank, by means of which the ratchet may be held by the hand when starting the drill; it can also be used for feeding by hand when desirable.

The step in the feed screw which takes the thrust in drilling, as well as the pawl, is made of tempered tool steel.

A small oil hole fitted with a screw provides for introducing a liberal quantity of oil, thus lessening the liability of the pawl cutting on the ratchet, the ratchet being entirely inclosed in the eye of the handle; the oil thus introduced does not readily go to waste. This covering of the ratchet also excludes dust and dirt, serving an important end in some situations in which a ratchet drill is likely to be used.

To avoid the usual loss of time in looking for something to serve as a pin for feeding, a feed pin is placed in the handle as shown. The pin thus becomes a part of the tool, and is always ready for use, for which purpose it is much better suited than the usual makeshift.

At the center *N* of cut, the ratchet is shown in use with the friction feed in operation; when thus used the lever is simply allowed to come in contact with some fixed object.

These drills are made to take the Morse taper shank, and also the ordinary square shank, the latter being sometimes desirable when the drill is being used where twist drills are not at hand or easily obtainable.

The foregoing, and an inspection of the engraving, will, we think, show this ratchet drill and its equipments to be a very complete tool of the kind.

A Watchmaking School.

A city the size of St. Louis might be wiped off Manhattan Island, and to a million or so New Yorkers the loss would cause little inconvenience. And yet St. Louis has an institution which the metropolis of America has not. Out in Chauncey I. Filley's burgh there is a school devoted to the teaching of the watchmaking craft. There is no such school here.

"I hope we shall never have one," said a down-town dealer in watches to day to a *Mail and Express* man. "It must be the most hairless fake on record. Why, it took me years to learn what I know of my trade under the instruction of a practical man in this very shop, and yet there are hundreds of watchmakers who have forgotten more about the business than I know. You can never learn how to make a watch in a school."

"Are watchmakers well paid?"

"Ordinary workmen get ordinary wages, but a superior man can command his own price. There are a very few good watchmakers in New York who are ever out of work, and yet it is practically the only trade in the city which is not organized. We have no use for a union."—*Mail and Express.*

Automatic Pumping Outfit.

The pumping outfit represented by the accompanying engraving consists of a sectional safety boiler and a steam pump mounted on the same base.

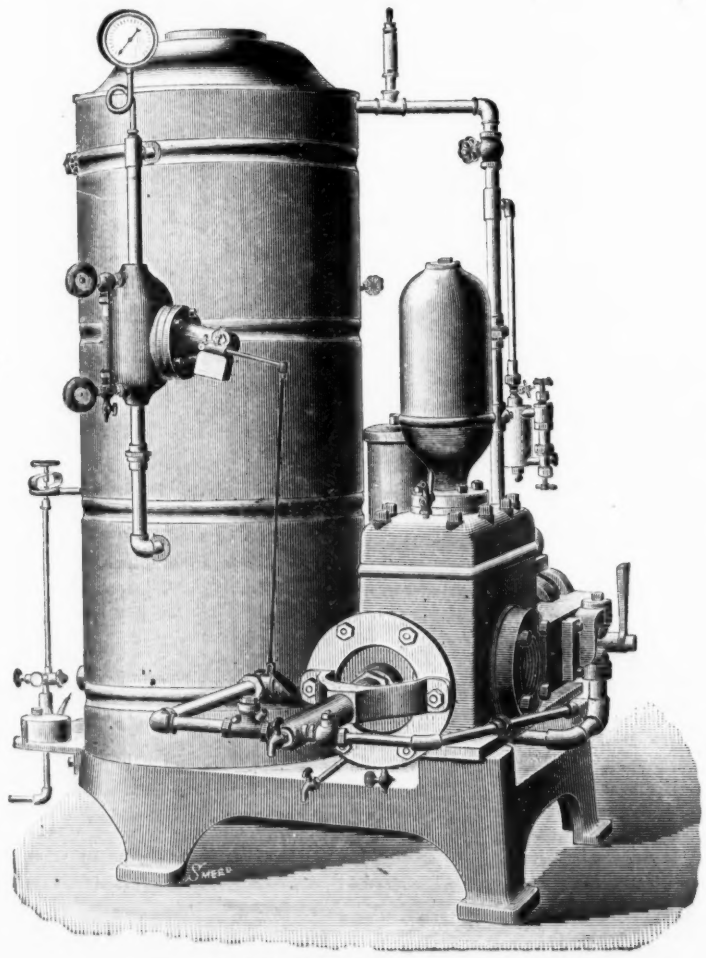
ADJUSTABLE FRICTION FEED.
SECTIONAL VIEW OF NO 3 RATCHET
EXTENSION FEED SCREW
NO 3 COLLET.
NO 5 COLLET.
NO 2 COLLET.
NO 1 COLLET.
NO 1 MORSE TAPER. SQUARE HOLE COLLET.
NO 1 RATCHET FOR DRILLING RIGHT & LEFT HAND ½ IN AND SMALLER.
NO 3 RATCHET FOR DRILLING RIGHT & LEFT HAND FROM ½ IN TO 1½ IN.
P & W CO.

THE RENSHAW RATCHET DRILL.

The boiler is of the well-known "Shipman" type, with which kerosene or one of the cheaper grades of oil is used as fuel. The oil is siphoned up from below the mouth of atomizer, and its use is, we believe, unattended with danger. The fire is automatically controlled by a diaphragm valve, maintaining the pressure practically constant.

A float in the chamber at the side controls the supply of water to the feed pump, keeping the water in the boiler at a constant level. The piston rod extends through the water cylinder head and carries the plunger of the feed pump, thus bringing the strains in a direct line, which is especially desirable at high speeds.

The outfit is designed for private residences, hotels, office buildings, railway water stations, etc. It is made by Shipman Engine Manufacturing Co., Rochester, N. Y.



AUTOMATIC PUMPING OUTFIT.

The Mechanical Engineers at San Francisco.

(Editorial Correspondence.)

As soon as the party of engineers from the East had had opportunity to retire to their rooms in the Palace Hotel for an hour or so of rest or unpacking of trunks, as the case might be, and had eaten a lunch, they were convened in one of the parlors of the hotel and formally welcomed to the city by Mayor Sanderson in a graceful address, in which he reminded them of the ties of friendship and relationship, which bound all Californians to the East, from which many of them came, and in which nearly all had dear friends whom they had left behind to come to this country and build up a mighty empire.

The average tourist, he said, came here and merely admired the country from the car windows while being whisked through it. He ate of the fruit, inhaled the fragrance of the flowers, and left, knowing practically nothing of California. With such a body of men as composed this society he expected it would be different. They were used to looking at and examining things for the purpose of knowing something about them. He hoped they would employ to the full their perceptive powers, and, returning home, spread the gospel of truth regarding California and what they saw there.

Ex-President Hunt replied on behalf of the society, first expressing regret that President Loring was unable, on account of illness, to be present. He referred to the great pleasure the visiting members had already found in viewing the wonders of the State, predicted that the meeting in San Francisco would be one of the most memorable and successful ever held by the society, and hoped that the resident members would some time give the eastern members an opportunity of paying back, in some small degree, at least, the hospitality which had been extended.

At the conclusion of the addresses Mr. A. S. Hallidie was introduced as the leader of a proposed expedition to view the cable roads of the city.

Mr. Hallidie, who resides here, is the originator of cable railroads for carrying passengers, the first road of that description having been constructed by him near his residence. At present the city is remarkably well provided with them, and many of the power stations are well worth seeing. There are many very steep and long hills in the city, upon which cable roads seem to be, and, in fact, are about the only available means of transportation, one street which I particularly noticed being so steep that teams and all vehicles drawn by horses avoid it, there being so little traffic in the street besides the cable cars, that grass grows luxuriantly among the stones of the pavement.

Before leaving the room, each member of the party was supplied with a neat black silk ribbon badge, lettered in gold, which badge, it was announced, would pass the wearer on any of the principal lines of cable or horse car roads of the city, and it began then to be apparent that, as proved true afterwards, San Francisco, with all that it contained, belonged for the time being to the visitors. The splendid hospitality of its citizens never flagged for one moment from the time we were met at the top of the Sierras by the welcoming committee, with flowers, fruits, and even the latest newspapers, which the thoughtfulness of Mr. Small had provided, until the party separated at the close of the sessions to pursue their various ways on the return to the Atlantic.

At 8.30 P. M. of the 16th the society met for its first regular session in the hall of the Academy of Sciences, ex-President Hunt in the chair. Dr. H. W. Harkness, president of the Academy of Sciences, read a short address of welcome, in which he paid a high compliment to mechanical engineering, predicted a still greater future for it, and extended to the visiting members the full use of the hall, library and museum of the academy.

A welcome was also extended by Mr. John Richards, on behalf of the Technical Society of the Pacific Coast, which was the first organized body to move in the direction of extending an invitation to the A. S. M. E. to visit San Francisco. Mr. Richards stated that the society numbered nearly 200 members, which, considering that it had a population of only 1½ millions from which to draw members, was a very creditable showing.

Evenings only were made use of for meetings of the society, the days having been fully appropriated by our hosts for entertainment and sight-seeing, of which I shall have more to say hereafter.

In addition to those already named in this correspondence, there were enrolled at the headquarters the following: C. Kirchoff, New York; Henry W. Bulkley, New York; F. M. Rites, Pittsburgh; F. W. Wood, Los Angeles; A. L. Burns, Brooklyn; G. O. Reinerson, Cincinnati.

There was also a good attendance at the meetings of local engineers and mechanics interested in the topics under discussion, who, though mostly non-members, took part by invitation in the discussions, adding much to the interest of the meetings.

Such professional papers, with the discussion upon them, as it seems desirable for us to publish, we shall present to our readers from time to time, as space can be found for them, while I shall go on in this correspondence with some account of what was seen on the Pacific Coast.

F. J. M

Direct or First Motion Haulage Plant.

The illustration on this page represents a wire-rope haulage plant made by J. & J. B. Milholland, Pittsburgh, Pa. It is what is generally termed a direct haulage plant, for the reason that the use of gearing is dispensed with, the drums being on the engine shaft, as shown.

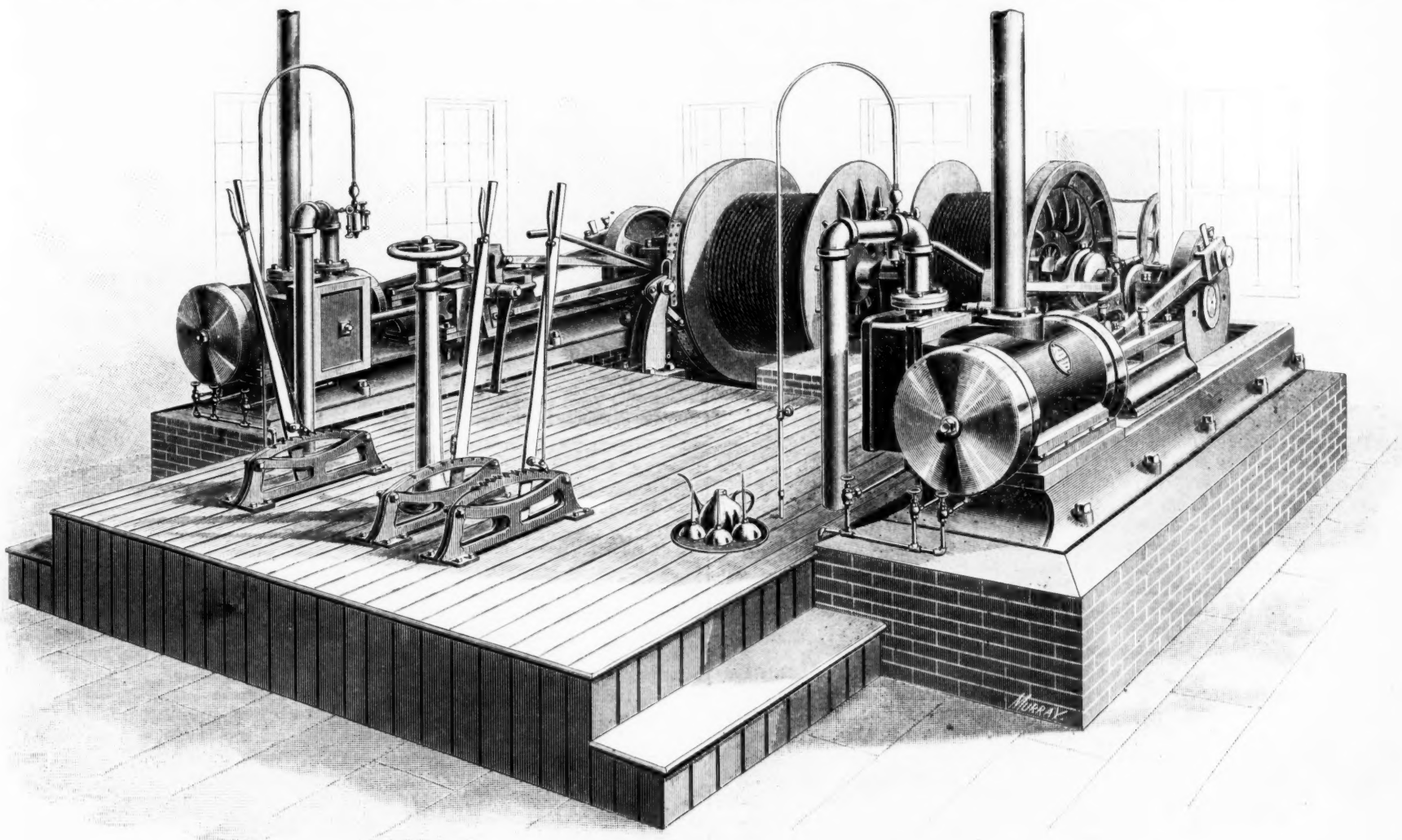
The engraving is representative of plants of different capacities made by this firm; in this instance the cylinders are 16″x30″, fitted with link motion for reversing and steam distribution. The drums are 4 feet diameter, 36″ wide on the face, and the flanges are 12″ in height, the capacity being two miles of ¾″ wire rope. The engines are fitted with such needed appliances as oil cups, sight-feed lubricators, drain pipes, oil cans, wrenches, etc.

Convenience of operation has been attended to. The throttle is operated by means of the hand-wheel shown on the top of stand at the center of platform, the links by the radius lever near the center, and the brakes by the two outside radius levers shown on the platform. The engineer stands on the platform just behind the radius stand and throttle, and has all necessary means at hand to give him complete control of the entire plant.

Either friction or positive clutches are provided, according to the wishes of the purchaser.

It will be seen by the engraving that the various parts of the machinery are heavy; no reasonable pains, it is said, is spared by the manufacturers in either material or workmanship. Such parts as piston rods, wrist pins, engine or drum shaft, etc., are made of hammered steel.

We are informed that these engines on their trial hauled forty-nine cars, weighing 180,000 pounds, up a grade of 4½ feet to the hundred.



DIRECT HAULAGE PLANT.

It is proposed to celebrate the Centennial year of the canal system of the State of New York with becoming ceremony. There is more propriety in doing this than in a great many other celebrations that occur. The canals of the State have done, in the past, a good deal to enrich it, and there is little doubt they will continue to be valuable to the people. They cannot very well be monopolized, and that is a good deal in their favor.

LETTERS FROM PRACTICAL MEN.

The Treatment of Steel.

Editor American Machinist:

Desiring to take a shot at the target set up in your issue of April 7th by A. D. Pentz, I hope you will indulge me in that desire to the extent of giving place in your columns to a few more words on "annealing steel."

"Much misinformation may have been written and otherwise perpetuated about steel, and especially about the hardening and annealing of it."

Yes, no doubt; now let's begin with the next statement: "Of course a piece cut off from a bar of good tool steel will be found too hard to be cut cold; must be annealed."

Sometimes, only; tons and tons of good tool steel have been worked, and will continue to be worked into the most delicate and intricate shapes cold without annealing. "One company only annealing steel, and that on one special brand of their stock."

Why, where have you been, Mr. Pentz? There are, and have been for a long time, dozens of steels of different makes and grades, both imported and domestic, annealed by the manufacturers. All of their stock annealed? No, that would not do. Too many steel users would not consent to let the steel maker nor anybody else anneal steel for them, and as there are many uses to which steel is put in which annealing is entirely unnecessary, and the cost of annealing is added to the price of steel, there is a good reason why the steel maker should only anneal a part of his product, leaving his customers to choose which they will have.

Is it best to anneal steel which goes through the processes of cold working to shape and subsequent hardening, regardless of whether it is soft enough to work without? I answer unhesitatingly, as a rule, yes, and will go further and apply the same rule to pieces forged to shape, whereby hammer strains and unequal tension of parts will be relieved, and the mass put into easy normal condition, by annealing. Annealing properly done is not the great destroyer of steel which some people believe it to be. It is often of great benefit aside simply from its softening influence, but to do it properly and thoroughly, without injury, requires almost as careful manipulation as is demanded for hardening. There is soft annealing which produces a disorganized condition of coarse, uneven crystallization, in which smooth cutting is impossible; the best of tools under the best condition will tear and cling. Such annealing is worse than no annealing, in that it makes it difficult to work the steel, and also does great injury, whether hardening is to take place or not. It is virtually throwing away the salutary effect of judicious working which has taken place between the ingot form and the bar.

"Such steel will refine by hardening and be all right." So will a piece of ingot steel or steel casting refine by hardening; but who doesn't believe that judicious working within reasonable limits is a good thing? This points to low heat for annealing if the benefit from working is to be realized. "Water annealing" is all right as a makeshift when there is so great hurry as to prevent waiting for steel to cool gradually, and it is well known that many steel workers believe that steel can be annealed in this way softer than by any other means. I once believed this, and for many years did my share of lauding the alleged wonderful merits of "cold water annealing." Now as a means on which dependence can be placed for uniformly soft annealing, softer than by other methods, I consider "cold water annealing" a myth.

Do I mean to say that steel cannot be annealed in that way? Not at all, but I do mean to say, and I believe that any reader who contradicts can be convinced by experiment, as I have been, that, however soft steel has been, or can be annealed by the water-annealing process, it would have been, and will be, softer if permitted to cool gradually until cold, from the heat at which it is customary to plunge it into the water to produce the alleged wonderful effect. What is that heat? Just when holding the steel in a dark place it ceases to show red. Just when charcoal dust ceases to sparkle when sprinkled on in the dark. Just when a stick drawn across it, hammer handle, for instance, is scorched. Too hot, too indefinite, possibly. It is the exact heat which does the business as determined when the steel comes to be worked. Should it be soft, the heat was right. If not, it is because the steel was cooled off too quickly, or not quickly enough. We have all heard this discussed over and over, and no doubt have often wrestled with water-annealed pieces which were too hard to be worked, but would have been soft enough to work all right had they been permitted to cool gradually.

Whether "exactly what annealing is, as a fact," is or will ever be known, need not trouble us particularly, so long as the processes are known and readily available by which thorough annealing can be done.

What are these processes? I answer, and challenge successful contradiction: Properly heating the steel and permitting it—forcing it—to cool slowly. To cool, I say, not to have the cooling process interrupted by quenching as soon as cooled from red to "entirely black."

"Cannot be hardened by quenching it, if, after being heated red, it is allowed to cool, so that it cannot be seen by that color in the dark." What is hardening? Of course the answer is, changing steel by heating and sudden cooling from a condition of softness, in which it can be readily filed or otherwise cut, or worked cold, to such condition of hardness that files or other cutting tools will make no impression upon it. But is it not a well-known fact that degrees of hardness are comparative? That steel of same hardening qualities at different heats, or cooled more or less suddenly, the same piece, if you please, successively at different heats, may be hardened so hard that no file will scratch it, and then by hardening at lower heat, or less suddenly cooled, be put in such condition as to be susceptible of being filed or drilled with much care at slow speed and with more or less injury to the cutting tools, will certainly be admitted to be true. Now is this not hardening in both cases? Following up the ground suggested by this, I contend that, given a piece of steel which is thoroughly annealed, is as soft as ordinary judicious annealing will make it, to be heated to annealing or hardening heat and permitted to cool to where it no longer shows red in the dark, still quite hot, will be hardened, not annealed. That is, if soft before this treatment, will be made harder. Is this not a fair statement? Does the fact that a hard piece of steel can be

made softer than before by cold water annealing prove the value of water annealing, or is it any more proven by the fact that steel already soft will not be hardened by it so much as to preclude the possibility of working it cold?

It certainly would be marvelous, if true, if steel of such temper as to require orange heat to harden it thoroughly hard, ordinary die and tool steel temper, should "become immeasurably hard if quenched at a low red heat, while if permitted to cool to heat a few degrees lower, it will be annealed to as soft a condition as it is capable of." It will do neither. It will demand its heat before it will harden "immeasurably hard." It will only be annealed to a condition "as soft as it is capable of" when permitted to cool gradually from suitable annealing heat, without the intervention of any cold water bath.

Another thing, boys; whatever you may do in the way of "perpetuating the great deal of misinformation written about annealing steel," don't you believe that "hard steel can be well annealed at a heat before redness is reached."

But we have struggled along to experiments made with "Jessop's steel," and, most marvelous of all, are told, virtually, that it makes no difference when steel is quenched for water annealing, only so that it has cooled below red, and that the old long-cherished box-annealing process is a fraud. The second experiments show up entirely on my side of the argument. "Heated to redness carefully." That was all right. Slow cooling intercepted, interfered with, in first two pieces; result imperfect annealing. Of course. "Third piece carefully heated to redness and covered with warm ashes to cool gradually." Good enough. Here is the whole thing in a nutshell; but this piece was quenched? Yes, after being permitted to cool until some time after it was certainly black.

"The disadvantage of re-annealing is that every time steel is heated without hammering it, it certainly deteriorates in quality." More attempt to perpetuate misinformation. Properly heated within the safe limit of heat for either annealing or hardening, but still sufficiently high to be effectual for both, it is being demonstrated daily in thousands of cases that steel shows no diminution of service in tools and dies in consequence of re-annealing, re-hardening, not simply once or twice, but a dozen or more times. It is improper heating which does the mischief, not re-heating.

"The present practice" in making milling cutters, of cutting them from round bars, is pernicious, is it? If the cutters thus made do as much work and fill all requirements as well as those forged from flat bars, what then? The fact is that this question of how steel should be used, whether with the alleged grain or across the imaginary "fibrous elongated" particles composing the mass, has never been satisfactorily settled. There are advocates of each practice who never do it the other way if they can help it. Do they give sufficient weight to the fact that it is so often the case where necessity, convenience or economy leads them to make tools the wrong, bad, ruinous way of the grain they turn out to be first class?

And next we are asked inferentially to believe that "jumping"—upsetting—is bad. Properly done, if steel is sound, there are many cases in which the effect is most salutary. If steel is unsound, seamy, it is quite likely to be brought out by upsetting, and so by being thrown out in the forging department valuable time may be saved which would be otherwise lost. If bar after bar of steel can be cut into pieces of such length as by upsetting will make disks of diameters varying from twenty per cent. larger than the bar up to more than twice its original size, these disks being used for milling cutters, dies, slitter blades, etc., with best of results, is it bad practice? Can they? They can. S. W. GOODYEAR.

Cost Keeping.

Editor American Machinist:

The communication of "Anglo-American," in the issue of May 19, opens again for discussion a subject regarding which much has already appeared in your columns, but which has been by no means exhausted. The matter of cost keeping must enter as a vital element into any substantial manufacturing enterprise, and the methods employed must receive, in their first introduction, such careful consideration that there may be no desire in the years to come to depart from the original methods. The system must be simple, easy of comprehension and application, must be one that will engender no ill feeling or suspicion between employer and employed, and must attain the desired end in the most satisfactory manner, with the least expenditure of clerical labor.

As the writer regards the subject, the time and cost-keeping systems must be entirely distinct—the object of the former being purely to ascertain the number of hours worked in total, the latter to learn the time required for certain operations, or for the making of the completed article. To this end some such means as the check system may be employed for time keeping, and a set of time cards introduced for the cost keeping. Local conditions and personal preferences naturally determine the character of such cards, but it is certain that, whatever its form, the card must at least specify the name of the piece, the number of pieces, the number of hours worked, and the name or number of the workman. To this may be advantageously added the character of the work done, *i. e.*, lathe, planer, shaper, milling, vise, etc., and the number of the tool on which it is done—this latter record being made possible by the consecutive numbering of all machines in the establishment.

If the given article is manufactured on a stated order properly and distinctively numbered (as it should be), all time cards relating to it can be filed together until all the work is completed, then sorted according to names of pieces and operations, and the time figured with little labor and in as much detail as desired.

In a similar manner piece-work may be reported upon and cost of completed articles made up. Memoranda of stock used, and reports of time of outside men, can be as readily dealt with.

The advantages of this system of cost keeping are that each man turns in his account as soon as his part of the work is completed; there is no daily posting of these accounts, but all reports are merely filed together, and whether accounts of total cost are made up or not, these reports are equally accessible at any time.

The cardinal principles should be that only one kind of a piece (unless absolutely impossible to restrict it to this) should be reported on a given card; that, so far as possible, the time on each distinct operation on the piece should be specified; and that each man should hand in his individual card, although some one may assist him on the work—all this in case you want *the best* and most complete record.

The writer would be pleased to learn of the exact percentage for establishment expenses that is added in cases with which your readers may be familiar. This is usually such a personal question as to be but little discussed, and figures seem to be wanting. Of course it is hard to make fair comparisons without full specifications of the items included under this percentage, as well as the character of the stock and of the finished article. WALTER B. SNOW.

The Mechanical Sphere.

Editor American Machinist:

If "Technics" (May 19th, 1892,) had carefully read "The Mechanical Sphere," he would have seen that my conic ovate, Fig. 1, has a section that is described from three centers, and that all lines through these centers and through the body of the conic ovate have a constant length, and that every line I called a diameter passes through one of these centers. Hence these lines passing through the body, and through the centers to which every surface of that body has concentric relations, may be described as diameters in the geometrical sense, and without a recourse to the Greek roots of "diameter" at all. The mean center, or middle point of my "conic ovate," has nothing concentric to it, bisects but few lines, and these are all diameters as I use the term; and no stretch of the geometrical term "center" describes it.

The term "conic ovate" has been used before by Craig to describe a conical body with a plane base and an egg-shaped top and apex.

"Technics" should reduce to principles his means to inspect the sphere, then he will find it to be but a modification of the ring and papers. It is the spherometer transposed, which is an excellent tool to determine the size of globe, of which any detached spherical surface may be a part. "Technics," however, is mistaken in supposing that there is any necessity for the micrometer screw to be "at right angles to the plane of these points, and in line with the center of the triangle formed by them," if it is to be used only to inspect the truth of a sphere, although Knight's dictionary shows a vernier micrometer in that position. It is obvious that the screw could be placed in circumferential relations to "Technics'" tripod, and between two of its feet, in which position it would be equivalent to the fourth piece of paper in the ring; and hence the spherometer is a modification of that ring and the strips of paper. In criticising an entity the writer should use his name. A. D. PENTZ.

Grindstones.

Editor American Machinist:

Why was the grindstone placed in that obscure corner where no light ever comes? And why was so much care taken to adjust the belt so precisely that conjointly with any pressure of the tool on the stone the belt flies off? In the present instance, by a change in the locality of the shop, and a consequent re-setting of machines, these evils have been done away with, but the places are not a few where such things still exist.

This may seem to some an unimportant subject, but in the opinion of those who work with good tools it is not. I have never owned or managed a large manufacturing concern—nor a small one either—but in a shop employing between 500 and 800 men all the year round, a large proportion of whom consist of cabinet makers, car builders, finishers, some carpenters and pattern makers, we think that a grindstone kept in condition for grinding wood chisels and plane bits would be worth its keeping.

In the place I speak of especially there is a stone which is used exclusively by the cabinet makers. It is in their department. For the rest, the stone is too fine, too far away and too slow to be used to advantage, so there is another provided which the rest are supposed to use, it being nearer at hand. Many times have we chosen to rub our plane bits and chisels up on the oil stone, rather than botch them up on this stone. It is a good, quick-cutting stone, with plenty of speed and power; but it is like a local option town; sometimes it goes dry and sometimes wet. When it is as it generally is we have first to hunt up something to carry water in and then hunt up the water, the nearest being a barrel of soapsuds outside. Then again there is a deposit at the bottom of the frame which on the surface has the glint of water. It is not; it is a thick yellow precipitate. This we are supposed to stir up with a stick, which may or may not be at hand. If not, we skirmish till we find one. It is admirably adapted to soil our shirts, obscure the edge of the tool and prevent it from wearing away the stone. Economy is wealth.

After the big bite that is taken out of the stone by the man who wants, and ought to have, a little one of his own, has been worn out by the continuous, careful application of chisels, etc., there follows a succession of angles and wave lines that go way past the 28th problem of the last book. A geometrician might be able to grind his knuckles on its variegated surface, but car builders, etc., want to grind their tools; they are not Euclids. When these problems are solved, there is still the cam movement, which develops a new outline every day, to catch on to.

To remedy these evils, a sign neatly written, on nice, white paper, bearing the edict, "Machinists must grind their tools in the tool room," was placed in a wrought-iron frame and fastened to the floor near the stone. By accident, somebody happened to see it, and forthwith a strong solution of thick yellow mud was smeared over it, almost obliterating the writing. And things go on as they used to.

Now, as I said before, I have never owned an establishment, and probably never will; but in my humble opinion it would be a good scheme to enforce the order about machine tools, make blacksmiths grind their cut hammers on the stone fixed for them, and instruct a man, if one can be found who has not already more to do than he can well do, to straighten that stone up every day, keep that foul smelling filth out of the bottom and have clean water at hand ready for use. I cannot ask them to put a wooden cover partly over the stone, with a bucket, with water in it, on top, and a spigot to regulate the flow. I don't want to sink the place—financially. But I think that slight reforms might gradually be brought about, say in a year or two, without causing a panic. PERHAPS.

Coal Consumption by Steam Engines.

Editor American Machinist:

"Technics," in your issue of 19th inst., takes exceptions to my statement that Messrs. Sulzer Brothers, of Winterthur, Switzerland, build and erect engines, and guarantee to develop a horse-power with *twelve* pounds of steam (water) per indicated horse-power, referring to Prof. Schroter's experiments at Munich, as published in London *Engineering*, December 5, 1890, as giving 12.58 pounds.

Mr. Carl Sulzer, one of the above-named firm, was a guest of mine in May, 1890, and in our visits to the different engine builders made the statement that their firm were now prepared to take orders for engines, and guarantee twelve pounds of steam per indicated horse-power.

I am satisfied from the reputation of the above firm that, in view of the advanced state of the arts, if their engines built prior to 1890 developed a horse-power with 12.58 pounds of steam, they have no difficulty in making the 0.58 pound reduction now.

WM. BARNET LE VAN.

On the Cultivation of the Inventive Faculty by the Solution of Constructive Problems.

BY LEICESTER ALLEN.

Mr. Percy J. Neak, of Rochester, England, sends a solution of the triangular movement problem, and says he regards the problem as "a very pretty one."

Mr. Neak's solution is substantially identical with that of Mr. Slocomb, which appeared in my article published in No. 11, current volume, the only difference being that he has substituted a tubular revolving cross-piece with a plunger guide for Mr. Slocomb's rectangular cross-piece and guide. The solution is entirely correct.

Mr. Leo Rebay, of Jersey City Heights, N. J., has sent a solution which fails, from the fact that the needle center describes a hexagon with three long sides and three short ones. This result is brought about by unnecessarily truncating the angles of the triangular guideway. The problem required that the center of the needle should describe an exact triangle.

Mr. Charles Eastop, of Ansonia, Conn., has sent a sketch of a movement which, having seven moving parts, does not conform to the condition that only four moving parts might be used.

Mr. Charles C. Bosworth forwarded a solution and a model of a movement identical with that of Mr. Slocomb above referred to. This model, though imperfectly made, and of wood, and evidently hastily constructed, shows that, with a proper tension of the extension spring, the angles are passed with ease, thus practically refuting the criticism of Mr. Francis W. Clough, in his

description of his movement, as given in my previous article, to the effect that "the limit of possibility of moving the block out of the corners" is nearly or quite reached in the movements described and shown by Mr. Slocomb and Professor Hood.

Mr. E. H. Powers, of Beloit, Wis., sent in a solution identical with that of Mr. Clough, as shown in Fig. 1 in my article in No. 16, current volume.

Mr. W. J. R. Alexander, of Meadville, Pa., forwarded a solution substantially embodying the principle of construction shown by Professor Hood, except that he omits the extension spring and uses an interior triangular guide instead. For the propelling arm he substitutes a circular disk having a radial slot through which the needle block pin passes, the needle block being hexagonal. As shown, it seems to me that there might be some possibility that in passing the angles the needle block might turn through an arc of sixty degrees, unless the speed of rotation were such that centrifugal force would carry the block firmly against the exterior triangular guiding edge.

Mr. Samuel Platt, of Lynn, Mass., has sent a solution which consists in a roller rolling against the perimeter of a triangular plate, the roller being pivoted to a sliding block in a revolving crank-arm, the block being kept against the guide-way by a spring, and the needle being loosely pivoted to the pin on which the roller turns. Here, again, the device must work in a vertical position gravity being depended upon to keep the needle parallel to itself in all points of its path. (The faults of the gravity principle were pointed out in my last article, and I will not further dwell upon them.) Of course the roller can be made to roll along the interior of a triangle as well as the exterior, by reversing the action of the spring.

I come now to some solutions which well illustrate the differences with which different minds view the same subject, and the various avenues which men select in their approach to the solution of any mechanical question.

The solution shown in Fig. 1 is correct, and is due to Mr. W. P. Tarbell, of Milford, N. H. Mr. Tarbell sends the following explanation:

"The moving elements, aside from the needle, are four in number, and consist of *three* gear wheels, each having a projecting tappet formed on its face and loosely mounted on studs projecting from the bed-plate; the *fourth* is a wheel loosely mounted on a central stud, the outer wheels being equidistant from each other, and geared to the central one. On the central stud, and next to the gear, is fastened a guide frame. This is of the required outline that the slide and needle are to describe, and, together with the groove and projecting ledge formed on it, provides a guide for the triangular sliding piece to work in.

"The sliding piece has a pin projecting through it, one end adapted to move in said groove, the other part being operated against by the rotating tappets, and supporting the needle. The sectional view given, Fig. 2, does not show the positions seen in Fig. 1, but represents the lower part of figure with the movable parts advanced one-half of a revolution.

"Fig. 1 shows one tappet as having carried the slide to the end of its movement in that direction, with the second tappet in position to move it forward, *not backward*, as the first tappet is shaped to prevent that, and insures its moving forward in the new track, when the guide pin again holds it until the next corner is reached, and so on. To reverse the movement and carry the slide in an opposite direction to that shown in my drawing, requires the relative positions of the triangular guide and the centers on which the tappets rotate to be changed. This is adjusted by rotating the central stud and guide to the left until one tappet clears the slide as the next one engages again.

"Belt connections could be used in place of gears; then we could dispense with our central gear or pulley, and would have the same number of moving elements."

This movement is ingenious. By placing the centers of the tappet wheels well out from the center of the main driving shaft, a very strong and positive motion can be imparted by it to the needle block.

Mr. R. I. Clegg, of Providence, R. I., has sent the solution shown in Figs. 3 and 4. In explanation of this solution, he writes:

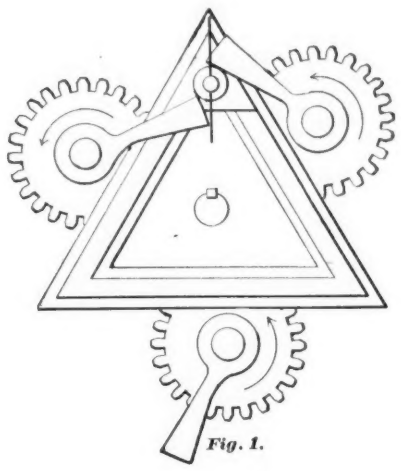


Fig. 1.

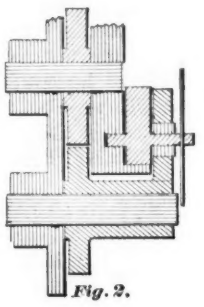
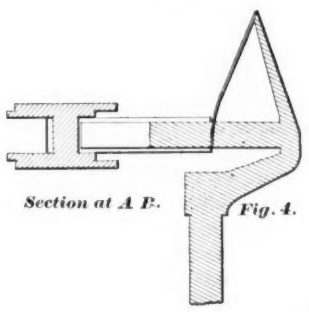


Fig. 2.



Section at A B. Fig. 4.

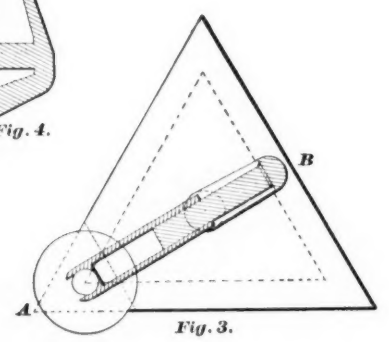


Fig. 3.

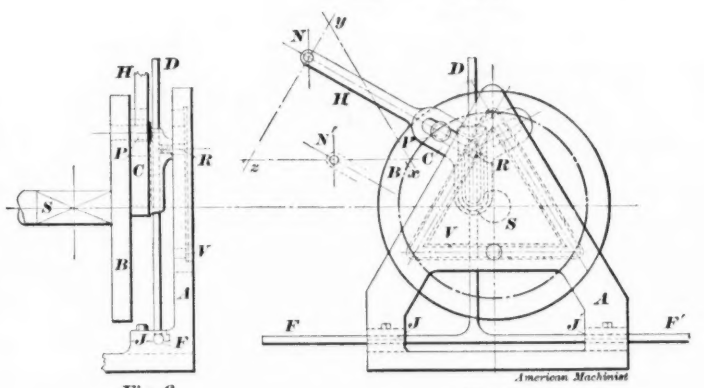


Fig. 6. Fig. 5.

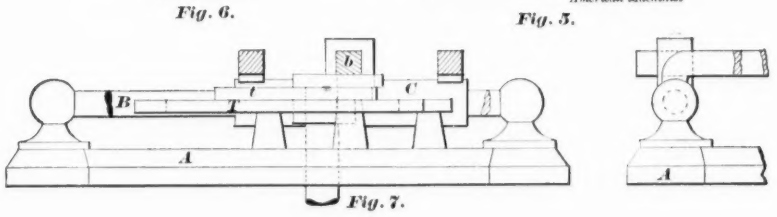


Fig. 7.

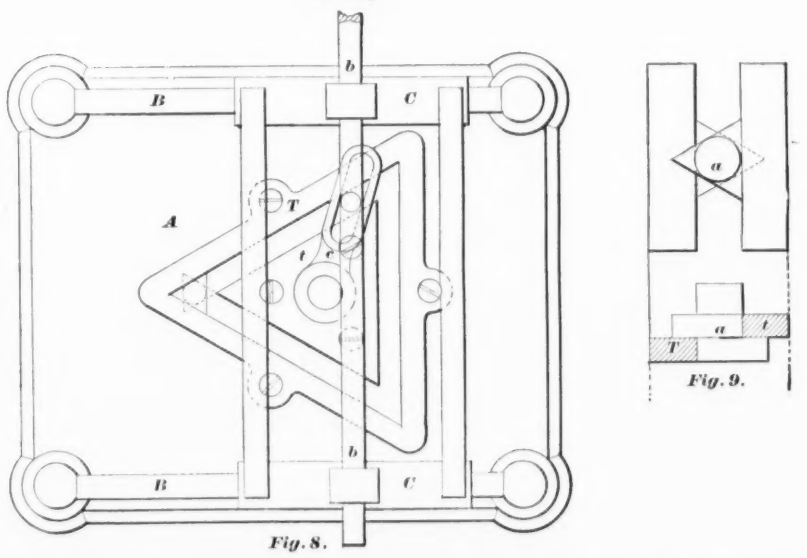


Fig. 8.

Fig. 9.

"The spring used to press out the sleeve is cut out at lower end to press on each side of sleeve.

"When I first sketched out the device, I used a spiral spring instead of the flat one, the spiral spring inclosing the inner sliding piece.

"A weight or gravity piece can be substituted for the springs, and is preferable, doubtless; but I show a spring, for the reason that, although I can apply a weight without adding to the number of parts required by the problem, the application would require a more complicated drawing.

"I would venture to remind you that in the device the pressure exerted by the spring is at its minimum when the mechanical efficiency of the lever is also at its minimum; and contrariwise, a condition of things that may justify the other shortcomings."

Mr. F. I. Hartwell, of Madison, Wis., sends a solution shown in Figs. 5 and 6. His explanation is as follows:

"As the purpose for which the device is intended is not stated, I have not tried to proportion parts, but merely submit my solution as *one* of the means for securing the desired *motion*.

"Referring to the inclosed sketch, *A* is a part of the frame containing the triangular slot *V*. This slot constrains the motion of the pin *R*, which is fixed in the three-armed block *C*. Therefore the block *C* must move in a triangular path. Motion is communicated to *C* by the pin *P*, made fast to the disk *B* which revolves with the shaft *S*. During a rotation of *B* the pin *P* passes successively from one of the three slots in *C* to the next slot at each vertex of the triangular slot *V*. One arm of *C* is extended at *H*, and carries the needle *N*. The block *C* slides vertically on the rod *D*, and horizontally on *F F'* (in slides *T T*) by means of the rigid connection of *D* to *F F'*. Therefore, as the block is held in its vertical position by the slide rods *D* and *F F'*, the needle *N* will preserve its vertical position and move in the triangular path *x y z* corresponding to the triangular slot *V*. Block *C* rests against the face of the disk *B*. The rod *D* might well be strengthened by connecting its upper end

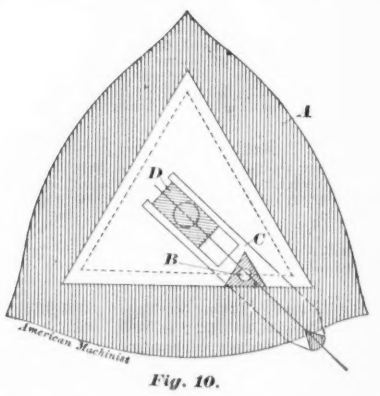


Fig. 10.

with *F* and *F'*. There are *only two* moving parts exclusive of the needle (which, I suppose, includes the part carrying the needle, of course). They are the disk *B* carrying the pin *P* and the slide rods *D* and *F F'*. It might be well to make the pin *P* into a roller, but I think it is not necessary to secure the motion."

Mr. Theo. H. Miller, of Elizabeth, N. J., sends the solution shown, Figs. 7, 8 and 9, accompanied by the following description:

"The device consists of a base plate *A*, at the four corners of which are fixed studs which support the bars *B*, upon which slides a carriage *C*. In suitable bearings upon this carriage the needle bar *b* is placed, and is free to slide through the bearings.

"To the base-plate *A* are also secured two triangles *T* and *t*, the latter being inside the former and above it, a distance equal to its thickness, as shown at Fig. 9.

There is a double triangular block *a*, arranged as shown, so that as it passes about the triangles *T* and *t*, there will at all times be two opposite flat sides of the block in contact with the guides, as shown in Fig. 9.

"The upper portion of the block *a* is cylindrical, and is engaged by the slotted crank-arm *C*, which is driven by a shaft from below."

Mr. Carl J. Ulmann, of New York City, sends two solutions, both correct, one of them being substantially like that forwarded by Mr. Slocomb, and another, shown in Fig. 10, introducing a principle of construction so far not shown by any other. Mr. Ulmann explains that by the use of "an outside cam formed of three conchoids on which a point of the bar *C* slides," the spring may be dispensed with, and the needle block may yet "be compelled to follow the outlines of the stationary triangular cam." "It is evident, however, that a much more mechanical motion could be devised if it were permissible to have the needle move on the line of a triangle with rounded corners."

Factory Inspector Connolly has brought suit against three iron companies in the Adirondack region for refusal to obey the weekly payment law.

The annual report of the directors of the Suez Canal Company shows that during the past year the traffic through the canal has increased 1,807,268 tons.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

AMERICAN MACHINIST,
203 BROADWAY, NEW YORK.

PUBLISHED WEEKLY AT
203 Broadway, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
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"Business Specials," 50c. a line.

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NEW YORK, JUNE 9, 1892.

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One-sided Tests.

But very little credit is given now-a-days to one-sided tests of machinery and engineering appliances. Some of these tests are no doubt made for advertising purposes. Instances sometimes occur in which one party sets forth the results of, say, a boiler test, showing remarkable results—often beyond the limits of possibility. Then, not to be outdone, a rival makes a test that gives a little better results, and so it goes; but, as intimated, the public is becoming skeptical in such matters, and, of course, engineers give no credit to the published statements.

In many instances the tests may be made with every intention of honesty, and still be far from correct. There is not a shadow of doubt that it is the easiest thing in the world for a man to "fool himself" if he is an interested party.

In the test of anything about which there is so much complication, and so many chances for error as there is in the instance of steam engines and boilers, no one without considerable experience in making such tests, and who is absolutely without prejudice, is competent authority. The party who pays the coal bills may know how much coal is used in a month or in a year, and the indicated power developed may be pretty accurately determined without the exercise of a great deal of skill of a high character. And this is a very good test indeed of the entire plant. But when it comes to making tests to determine the possibility of economy in a few hours' run, obtaining, perhaps, the economy of boiler and engine separately, the question is quite another one; such tests will not now be accepted except upon undoubted authority, and the publication of anything less carries very little weight.

Single Valve Engines.

Not very long ago it was almost universally conceded that nothing in the way of an early cut-off in the cylinder of a stationary steam engine could be accomplished with a single valve, at the same time obtaining a reasonably economical steam distribution. This belief prevailed long after the use of the link motion on locomotives, where the steam is so well handled by the operation of the link and single valve as to have kept other means for the most part out of the field. The practice, after it was found that some lap could be added to a slide valve, soon came to the point of making it such as would cut off the steam at an average for both ends of the cylinder of three quarters stroke; this was thought to be about the limit to expansion possible with a single valve. Now single valve automatic engines are made to cut off at as early a point in the stroke as is desirable—many of them being so constructed that following with steam for three-quarter stroke is not possible, and the steam distribution is very good indeed; not quite equal to that of four-valve engines, but not so much behind in point of economy as would appear probable. The multiplied demand for small engines no doubt had a good deal to do with the perfecting of the governing devices, and with determining that it was not necessary that they be full-stroke machines; and the perfecting of the mechanism has had as much to do with increasing the demand for them.

The advent of small automatic steam engines, run at high speed, has wonderfully helped in bringing about better design and construction, not only in steam engines, but, by the logic of example, in other machines and machinery. The high speed of these engines, and the greater strains due to high pressure, have demanded a care and pains in their design and construction that has made a mark on all machine construction.

Some of the best made small automatic steam engines of to-day are marvels of precise and smooth running, and their lasting qualities are excellent; the number of them sold yearly is an important item in the business of the country.

Another thing that the small automatic steam engine is largely responsible for is higher rotative speeds in larger engines. The comparatively large power that is obtainable from the smaller types of engines, for the space occupied, led to a better knowledge of the fact that the limit of speed had not been reached with the releasing gear, engines with this gear now frequently being operated at speeds not thought practicable a few years ago. Altogether, the modern small high-speed automatic engine has not only proved a success as a machine, but it has been a success as an educator, in more senses than one.

Let It Alone.

It would be even more amusing than it is were it not for the fact that so much misdirected energy is expended, to note the honest attempts made by those who know nothing of the subject at issue, to improve and invent things connected with mechanical and engineering matters. It has passed to a proverb that any reader of a newspaper can tell the editor what he should and should not do to please his readers, but the average newspaper reader is hardly more prone to a belief in his own abilities in that direction than the man who knows nothing about the subject in question—and who obviously does not read much anyway—is to think he can improve about everything in the mechanical or engineering line.

A large percentage of the patents issued in the world are issued to men who have spent their time and money working at—or thinking they were working at—things quite beyond their depth, and about which they did not possess even "a little learning"; and still more time and money is wasted in the invention of things old and threadbare.

It seems strange that any man should set out to improve—the steam engine, for example—without at least reading some elementary work on the subject, but there are many that do so, to their eventual discomfiture. An instance of this is given on the authority of London *Engineer*. It is the instance of a man who communicates some startling information regarding his improvements to a local Scotch paper. This correspondent has done, so he says, three things that no engineer in the world has done before, viz., he has found the means—discovered or invented, we suppose—of reversing an engine without the use of eccentrics; of balancing the slide valve, and of cutting off steam at any point in the stroke, "thereby making two revolutions with one cylinderful of steam". He has also discovered other things of minor importance, and altogether he can save sixty per cent. of the steam now used. It is quite easy to believe that he has an engine "partly made"; there would be no trouble in that, if his money kept pace with his convictions.

All this looks particularly ridiculous to those who have even a very elementary knowledge of the state of the art in steam engineering, and the construction of steam engines, but it can undoubtedly be paralleled in many other branches of engineering. Just as the man who knows nothing of the simplest elements of mechanics runs after perpetual motion schemes, and is always expecting to find a way in which he can get something for nothing, so the man who is ignorant of the details of a certain branch of engineering is very likely to lead himself away in the belief that he can improve everything connected with it; likely as this man who has improved the steam engine to invent things in common use, or things that have proved themselves worthless.

The moral is in the direction of becoming acquainted with what has already been done, or is being done every day, before trying to make improvements. It pays better in the long run, and is more satisfactory in every way. The best advice a man can have who is bent on improving something that is an enigma to him is: learn a good deal about it, or let it alone.

Bills now before Congress, and likely to be brought before it, seem to be the outcome of the rather prevalent opinion that the engineering department of the navy is not receiving proper consideration. One of the bills referred to provides for increasing the engineer corps, and this is vigorously attacked by the line officers, ostensibly on the ground of economy. A comparison, however, with the British navy, with which the naval engineers meet the argument of the line officers, shows that the proportion of line officers to engineers is nearly twice as great in United States vessels as in British vessels. From this it would appear that if economy is the real motive for the opposition to the bill, the most logical advice would be a decrease in the line officers. But the probable reason for the opposition is not for economical reasons. The line officers of the navy are not disposed to favor the members of the engineer corps taking their proper rank and position, and are kicking against the inevitable. It is hard for them to see that the modern warship is a great fighting machine, and that its success must depend largely upon the engineers—the mechanics—who manage the machinery with which she is fitted. It is inevitable that the engineer shall come more and more to the front in naval matters, and he is entirely right in insisting that his position shall be respected.

The boy in the shop who asks questions should by no means be discouraged in laudable efforts to get information in that way. Many a man knows less all his life than he would have known if he had been encouraged when young to exercise the privilege of asking about things in which he was interested. But, on the contrary, there is such a thing as carrying the right too far. One does not have to be brought a great deal in contact with boys, or men, as to that matter, to find that with some the habit becomes chronic to such an extent as to seriously interfere with all practice of finding out things by investigation. Not infrequently people will go to materially more trouble themselves, to say nothing of troubling others, in finding out something by asking about it, than would be required to find out for themselves. It is then that the habit becomes, as it were, a brake on progress, and a mild nuisance to others. If it is true, as it undoubtedly is, that we cannot well get along without asking a good many questions, it is quite as true that we cannot get ahead without finding out a good many things for ourselves. The boy who destroys things, sometimes, to find out something about the mystery of their construction, is more to be tolerated than the one who knows nothing except by asking about matters which he can readily determine for himself.

It can be set down to the credit of the bicycle that it is the means of bringing about a good deal of discussion as to the condition of the common roads in the United States. Manufacturers of bicycles, and those who use them, are interested in the question, and in addition to a good deal of verbal discussion there has been some very interesting matter printed about roads. It has been rather conclusively shown that the improvement of our highways is not so serious a matter, financially, as it has been generally considered, and the universal advantages of good roads have been brought to the front. If those whose interests in roads center mainly about the "wheel" shall bring about a much-needed reform there will be good reason for blessing its inventor, whoever he may have been.

The Newark Manufacturer and New Jersey Industrial Review is the rather long name of a small eight-page monthly paper published at Newark, N. J., the initial number of which is at hand. We wish it success in its avowed purpose to work for New Jersey interests.

Mr. Angus Sinclair has been making a test of the locomotive that hauls the fast train the fastest in the world Mr. Sinclair says—on the New York Central Railroad, and he arrives at some conclusions that are not in accord with generally received opinions. For example, he calculates that at a speed of sixty miles an hour a pull of only fifteen pounds per ton weight of train is required, which is materially less than has

very generally been believed to be sufficient. He concluded that the coal consumption was three and one-eighth pounds per horse-power per hour; this will be considered an excellent result. It would be of great advantage if tests of locomotives in regular service were more frequently made. A more general knowledge on the subject of work done and fuel consumed by locomotives differing in construction would lead, it must seem, to bringing about increased economy, as it has undoubtedly done in the case of stationary steam engines.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(244) E. C., Camden, Ark., writes: Please give through your columns the proper dimensions for a boat suitable for the below-mentioned machinery. Vertical boiler 39 inches high, 24 inches diameter, 32 tubes 2 inches diameter; the tubes are submerged. Vertical engine, cylinder 3 inches diameter, stroke 4 inches. I want to make a speed of 10 miles per hour against a current of about 3 miles per hour. Give size and pitch of propeller. *A.*—Length of boat, 22 feet; breadth outside, 4½ feet; depth, 2 feet; propeller, 20 inches diameter; pitch, 36 inches. To make the required speed against the given current you will need very fine lines for the boat.

(245) A. F., ——, Pa., writes: Kindly enlighten me a little on the following: I am desirous of getting information in setting up engines and boilers as power plants. I am a good mechanic, but have never had any out-door experience. Have you ever written up the subject of erecting power plants? If so, please refer me to the issues. Is there any work published on the method of doing that class of work? If so, please give name of author, and price. I wish to know how to set the engine in line with the line shaft, and the best way to fill under bed of engine, and which substance is most used for that purpose—cement, lead or brimstone. *A.*—You may get many useful points in regard to setting engines in line from an article treating on this subject in our issue of August 28, 1880. The book entitled, "How to Run Engines and Boilers," by E. P. Watson, 150 Nassau street, N. Y., noticed in our issue of March 31, current volume, may also be of service to you. The price of this book is $1.50. Portland cement is probably used the most for setting the bed of an engine, and brimstone stands next for the same purpose. Actual experience is, of course, the best tutor, and after you have assisted in setting up two or three plants, then, in connection with the information you may obtain in reading technical journals and books relating not only to the erection of engine and boilers, but to their construction also, you should have no difficulty in setting up engines and boilers of any kind.

(246) D. S., Charleston, S. C., asks: How many times more water will a 2-inch pipe discharge than a 1-inch pipe, conditions, pressure, etc., to be the same. *A.*—This will depend on the ratio of the head to the length of pipe. When the head and length of pipe are given you can easily compute the velocity of water by the formula given in answer to Question 21, in our issue of January 14, current volume. Multiplying the area of the pipe by the velocity thus found will give the discharge in cubic feet per second. In the formula referred to a friction factor is given, which varies with the roughness of the interior surface of the pipe, with the diameter and velocity of flow. Since a table containing these friction factors is not always at hand, the following formula, in which no such factor occurs, may be used, which gives a close approximation.

$$v = 48 \sqrt{\frac{h}{l}} \times d,$$

in which v denotes the velocity in feet per second; h, head in feet; l, length of pipe in feet; d, diameter of pipe in feet. To show the application of this formula to your question, we will assume that the head is 10 feet, length of pipe 100 feet; then by substituting these values for the symbols in the above formula we have for the velocity of water in the 2-inch pipe

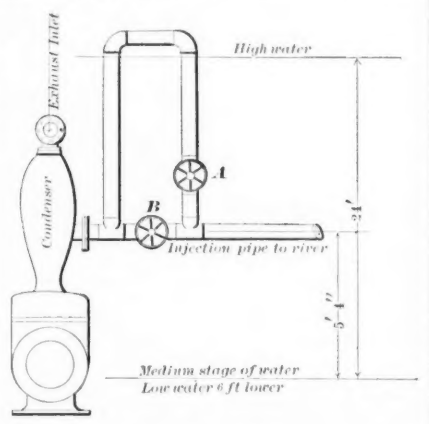
$$v = \sqrt{\frac{10}{100}} \times .16 = 6 \text{ feet},$$

the small fraction being neglected. The area of a 2-inch pipe is .021 of a square foot; hence the quantity discharged per second will be $6 \times .021 = .126$ cubic foot. The velocity of water in the 1-inch pipe will be

$$v = \sqrt{\frac{10}{100}} \times .083 = 4.37 \text{ feet},$$

and the quantity discharged will be $4.37 \times .005 = .021$ of a cubic foot per second.

(247) E. H., Portland, Oregon, writes: I am about to put in an independent air-pump and jet condenser, and I would like to ask your opinion about a certain point in connection with it. It is intended to take the condensing water from the river, and as it rises at times to such a height that it would be impossible to place the condenser high enough so as not to have the water flow to it at more or less head, and still be within the limits of suction, and as the latter is not advisable on account of the danger of flooding in case the pump should fail to operate, I have thought of arranging the injection pipe as shown by the inclosed pencil sketch, and thereby avoiding a high lift of the



water. Ordinarily the valve A would be closed, but should the water rise to such a point which would cause danger of flooding, the valve A would be opened and B closed. I have been told that, even with this arrangement, the water would flow through the U bend, and to the condenser, just the same as though the pipe were straight. I cannot see how the water could siphon over, for immediately the pump stops, the vacuum is broken. This is quite a large condenser—500 horse-power—and I am going to quite an expense to put it down as indicated; therefore, please give me your kind advice and greatly oblige. *A.*—When the water level in the river is higher than the injection pipe, the U bend will continue to act as a siphon after the pump has ceased to operate, and there is danger of flooding the condenser. By putting a small pet cock on top of the U bend, which can be opened when the pump stops running, the danger of flooding will be avoided.

(248) G. E. K., Pittsburgh, Pa., writes: Kindly inform me through your columns how thick the body of a 4-inch cast iron globe valve should be to stand a working pressure of 700 pounds per square inch. Also give an example to show how you compute the thickness. *A.*—In order to show how to compute the thickness for the spherical part of the valve, we shall assume that the inside diameter of this part is 6 inches. Let d denote this diameter in inches, and p the internal pressure per square inch. The total pressure which tends to produce rupture around the great circle will be $\frac{1}{4} \pi d^2 p$, in which π denotes the ratio of the circumference to the diameter = 3.1416. Let S be the safe tensile stress per square inch, and t the thickness of metal in inches; then the resistance to the pressure will be $\pi d t S$. Since the resistance must be equal to the pressure, we have

$$\frac{1}{4} \pi d^2 p = \pi d t S. \quad (1)$$

This reduces to

$$p \times d = 4 \times t \times S. \quad (2)$$

Hence, to find the thickness of the spherical shell, we have

$$t = \frac{p \times d}{4 \times S}. \quad (3)$$

Which reads: Multiply the pressure per square inch by the inner diameter of the spherical shell, and divide this product by 4 times the safe-working tensile stress. For cast-iron we may take the safe-working tensile stress at 3,500; now substituting the numerical values for the symbols in formula (3), we have

$$t = \frac{700 \times 6}{4 \times 3{,}500} = 0.3 \text{ of an inch},$$

or very nearly ⅜ inch. For finding the thickness of the cylindrical branches, the following formula is used:

$$p \times d = 2 \times t \times S, \quad (4)$$

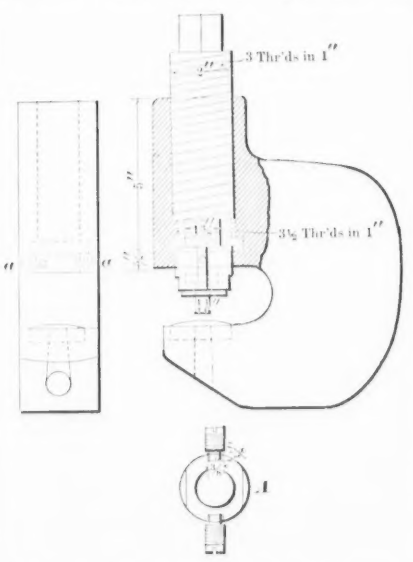
from which we get

$$t = \frac{p \times d}{2 \times S}. \quad (5)$$

in which the symbols denote the same quantities as before. Substituting the numerical values for the symbols in formula (5), we get

$$t = \frac{700 \times 4}{2 \times 3{,}500} = .4 \text{ of an inch}.$$

(249) B. D. T., Petrolia, writes: I inclose a sketch of a screw punch with differential screw which I made recently, expecting to gain a great advantage over the single screw. The sketch, I trust, is sufficiently plain. The punch is arranged so as to use the outside screw singly, or the combination. The inner screw is made with a head on lower end shown in end view at A, with a groove on each side ⅜ inch wide and ⅛ inch deep, to receive the points of the set-screws a a. This prevents the inner screw from turning when using the combination. To use the single screw we run the outer screw clear down on the inner one, and turn back the set-screws a a until they are clear of the grooves. The only information on the subject of friction of screws I have seen is that which is given in Prof. Ball's "Experimental Mechanics," which gives the efficiency as 36 per cent. It was not clear to me why two screws should absorb more of the power applied in friction than a single screw, and I might add, it is not clear yet. To be on the safe side I allowed 75 per cent. loss and made the following calculation, taking "Box" as authority for the punching strain, who gives $S = d + t \times 68$ for iron. The iron to be punched was ¼ inch thick, and the punch was $\frac{11}{16}$ inch diameter. This gives $S = \frac{11}{16} \times \frac{1}{4} \times 68 = 11.7$ tons of 2,240 pounds = 26,208 pounds. The pitch of the outer screw being ⅛ inch, and that of the inner ⅜ inch, the punch would advance in one revolution $\frac{1}{8} - \frac{2}{7} = \frac{1}{91}$ inch. Taking the lever at 18 inches the pull on the same equal x and allowing 75 per cent. loss from friction, $113\ x = 4\ (\frac{1}{91} \times 26{,}208)$, from which $x = 44$ pounds, which, if my calculation is correct, is very nice. Now for actual results. The experiments I made were necessarily crude, but served to give comparative results, and the one made with the single screw agrees remarkably well with those given by Prof. Ball. The first trial was made with the single screw. The punch was placed in the vise with screw horizontal and the punch screwed down on ¼-inch iron until it commenced to go hard. The lever was then weighted at a distance of 47¾ inches from the center of the screw. To commence, the lever stood about three inches above the horizontal, and weights were added until it descended; the lever was given a slight start with the hand. Two holes were punched in this manner, one requiring a weight of 85 pounds and the other 79 pounds, the mean being 82 pounds. I calculated the work of friction as follows: I took Box's rule for the strain on the punch, and the formula $F = W - m$, and obtained $F = (82$ pounds $\times$ 300 inches) $-$ (26,208 pounds $\times$ ⅛ inch) = 15,864, which gives $\frac{15{,}864}{24{,}600} = 64.5$ per cent. of the power applied, lost by friction. This agrees perfectly with one of the experiments made by Prof. Ball. The combination was next used with the same lever and iron. Two holes were punched, one



taking 100 pounds and the other 90 pounds, the mean being 95 pounds, which gives $F = (95 \times 300) - (26{,}208 \times \frac{1}{91}) = 27{,}252$; this gives $\frac{27{,}252}{28{,}500} = 95.62$ per cent. lost by friction. Both screws were of tool steel, and the body was of the same material not hardened, and well lubricated with lard oil and plumbago. They were nicely fitted and could be run in and out by hand, and were without perceptible shake. The tendency of the inner screw to turn when using the combination was not excessive, as it could be held from turning by a 12-inch wrench easily with one hand, the set-screws a a being turned back to clear the grooves. Kindly answer the following questions: 1. Are my calculations correct? *A.*—Yes. 2. Is it generally known that so much power is lost when using the differential screw? *A.*—We do not know whether it is generally known, but a little reflection ought to show that in a differential screw the friction of two screws comes into play, and consequently its efficiency must be less than that of a single screw. 3. If this is generally known, why is it not put in available form, thereby preventing others from threshing old straw? *A.*—It is probably the want of sufficient experimental data that prevents writers from giving the efficiency of a differential screw; but there are authors who mention the fact that the friction in a differential screw is very great. 4. Is there a greater percentage of loss from using a screw with fine pitch than with coarse pitch? *A.*—In answer to Question 233, in our issue of May 26th, current volume, we have given a formula for finding the efficiency of a screw; applying this to screws of given pitch it will be found that, within practical limits of the pitch, less power will be wasted with the coarse pitch than with the fine pitch.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Wheels, Gear Cutting, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

"Boiler Tests by Barrus." Get sample pages from Gowing & Co., Mason Building, Boston, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Most sensitive and durable Damper Regulator made; works within one pound. Send for circular. T. Kieley, 11 W. Thirteenth Street, New York.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., cor. Canal and Washington Sts., Chicago, Ill.

25" / 32" / 37" / 42" — "Only Drill Press built on 'Ko-rekt' principles, Even if they come from Jersey." Gould & Eberhardt, Newark, N. J.

Just Pub.—Safety Valves, History, Invention & Calculation. By W. B. LeVan. Fully ill. $2. Cat. of Machinists', Electricians' & Engineers' books sent free. N. W. Henley & Co., 150 Nassau St., N. Y.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases.
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886 issue; must be unsoiled, and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Just Published: "Ways & Means" for Machinists & Metal Workers. A new work, thoroughly practical, containing new matter that no intelligent mechanic should miss. The cheapest work ever issued, 160 pp., 150 illustrations, including working details of the latest mach. tool design & prac. Cloth. Price $1. John W. Weston, Pub. Journal of the Association of Eng. Societies, 78 La Salle St., Chicago.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1 00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Japan is said to possess a timepiece exhibiting remarkable mechanical genius in its construction. It is contained in a frame 3 feet wide and 5 feet long, representing a noonday landscape of great beauty. In the foreground plum and cherry trees and rich plants appear in full bloom; in the rear is seen a hill, gradual in ascent, from which apparently flows a cascade, admirably imitated in crystal.

From this point a thread-like stream meanders, encircling rocks and islands in its windings, and finally losing itself in a far-off stretch of woodland. In a miniature sky a golden sun turns on a silver wire, striking the hours on silver gongs as it passes. Each hour is marked on the frame by a creeping

tortoise, which serves the place of a hand. A bird of exquisite plumage warbles at the close of each hour, and as the song ceases a mouse sallies forth from a neighboring grotto, and scampering over the hill to the garden, is soon lost to view.—*St. Louis Republic.*

A correspondent writes us:

I notice that the Leffel Water Wheel and Engine Company has made what may be considered a welcome and very sensible move, by shortening the name of the company to The W. C. Leffel Co. This is an example well worthy the attention of other concerns in the country, who seemingly endeavor to express the entire business they do in their letter headings. Many of the largest firms in the country have the shortest names, which in every way seem more satisfactory to all concerned than a long name with a dozen words in it.

The length of railway communications open to traffic in India in March last was 16,890 miles, at at the same time the length under construction was 1,684 miles. The corresponding figures in March last are 17,375 and 2,160. Thus during the twelve months 485 miles have been opened, and an additional 960 miles have been taken in hand. The construction of railways in India was commenced in October, 1850, and the date of the first opening to traffic was August, 1853. So, since the commencement of operations, there has been an average addition to the open mileage of about 420 a year.

The danger of carrying coal as a cargo was exemplified by the destruction of a vessel off the Oregon coast. It appears that a lighted lantern was carried to where the coal was stored, when a terrible explosion occurred, injuring the vessel so that she was deserted by the crew, several of whom were injured, some fatally. Perhaps, though, the danger is not so much in the carrying of the coal as in taking a light where the coal has been shaken up for some days without opportunity for the gas to escape from the inclosed space.

Among the experts employed at the Bath Iron Works is a talented copper worker who is foreman of a copper shop. Not long ago he took a small copper cent, hammering it into a miniature tea-kettle. The words "one cent" occupy all the space on the bottom. There are a swinging handle and a movable cover, while the kettle is hollow, and the nozzle too. Water can be boiled in it. Eight hours' labor was given in the making. The artist's name is Robert Ducker and he receives $27 per week.—*Kennebec Journal.*

The City of Paris showed what she can do in the way of destroying her antagonists when she sails under the American flag, by running into and sinking a dilapidated craft devoted to pile-driving about the docks of New York. To be sure it was an American craft that was sunk, but then this was only in the way of practice. It is gravely stated by a daily paper that the great steamship accomplished the feat without "sustaining the slightest damage."

Another correspondent writes us, anent the catalogue question, that he believes they are out of date; that their place should be filled by books by manufacturers, sold at reasonable prices, giving plain directions for setting up and running their machines, the care they require, how to repair them when necessary, what kind of work can be done with them, and how to do it, etc. He concludes: "We 'want to see the wheels go around,' if we do pay for it."

In Kentucky the courts have held that a passenger holding a limited ticket may complete his journey if he starts before midnight of the last day of the limit, and makes the trip continuous.

The Rensselaer Polytechnic Institute, Troy, N. Y., is preparing to make a notable exhibit at Chicago. It promises that it will greatly excel the one it made at the Paris Exposition, where the institute was awarded a grand prize. The exhibit will include maps of this country and of the world, upon which will be shown the bridges, railroads and other engineering works built from plans by the graduates of the institute or under their supervision.

MANUFACTURES

J. W. Christian is to establish a machine shop at Dermot, Mich.

Bridlehurst & Ewing will erect a 19x59-foot engine house at Philadelphia, Pa.

New machinery may be placed in the Louisville (Ky.) Cotton Company's mill.

The Sag Harbor (N. Y.) Tool Co. has been incorporated. The capital is $20,000.

The Smith & Sharp Mining Co., Iron City, Tenn., is to put in a plant for washing ore.

The Fort Worth & Rio Grande will soon erect machine shops in Brownwood, Tex.

The Standard Hub and Block Co., Philadelphia, capital $200,000, has been organized.

The Laramie (Wy.) Electric, Gaslight and Fuel Company will enlarge its steam plant.

The Rahway (N. J.) Electric Illuminating Company will erect a new 11.x35-foot building.

The Walworth Manufacturing Company, of Boston, Mass., will erect a new $7 000 building.

The Tupelo Foundry and Machine Co., Tupelo, Miss., is to add new machinery to its plant.

W. J. Carter & Bro., Dublin, Ga., will double the capacity of their foundry and machine shop.

J. W. Christian will start a machine shop in Dermont, Ark., in connection with his wagon shop.

The Carrollton Railroad Company will probably erect an electric light plant at New Orleans, La.

Thomas Kingsbury will erect a machine shop in the rear of 1814 Washington street, in Boston, Mass.

The Spencerville Machine Company, capitalized at $20,000, will establish a plant at Spencerville, O.

John Schroeder, of Rush, is making arrangements for the erection of an ice factory in Rockdale Tex.

It is stated that a new concern is to be organized to establish a paper manufactory at Holyoke, Mass.

The New England Machine Company has been incorporated at Bennington, Vt.; capital stock, $100,000.

It is stated that the Charleston, Sumter & Northern will erect extensive machine shops at Sumter, S. C.

The Norfolk & Western Railroad will erect machine and repair shops and roundhouses at Kenova, W. Va.

It is probable that the iron works at Bradford, Mass., will be enlarged some time in the near future.

The county commissioners of Denison, Tex., have let contract for the construction of four iron bridges.

The South Florida Fertilizer Company has been chartered, with a capital stock of $10,000, at Jacksonville, Fla.

The Pittsburg (Texas) Foundry Company, lately organized, etc., has obtained its charter; capital stock, $10,000.

F. E. Reed & Co., Worcester, Mass., have issued a catalogue illustrating various sizes of lathes made at their works.

The Morgan Iron Works, at Spartanburg, S. C., are preparing to enlarge their plant, and will add new machinery.

A stock company may be organized, to erect a fertilizer factory at Way Cross, Ga. H. W. Reed can give information.

The Smith Cotton Hoe Co. has been incorporated at Atlanta, Ga., to manufacture agricultural implements. Capital stock, $50,000.

It is said that sixty acres of ground have been purchased at Denver, Col., as the site for the Jones Vestibule Car Company's works.

It is reported that a new steel plant will be established at Baltimore, Md., to manufacture by a new process, and to employ 100 men at the start.

The Safety Barb Wire Co. has been incorporated, at Toronto, Can., with a capital stock of $75,000, to manufacture wire, barb wire, wire nails, etc.

The Chicago (Ill.) Copper Manufacturing Co. has been organized, with a capital of $20,000, to manufacture sheet copper, brass and other metals.

Waddell & Shelton will organize a stock company to erect an electric light plant at Lexington, Va.; capacity to be 1,000 incandescent and fifty arc lights.

The Bentonville (Ala.) Hardware Company has been incorporated, by N. B. Cotton, B. W. Sedwick, O. P. Clark and others, with a capital stock of $15,000.

The G. A. Gray Co., Cincinnati, O., send us a neatly printed and finely illustrated catalogue of spur-geared and spiral-geared iron planers built at the works.

The Montague & Lea Machine Tool Company, at Moundsville, W. Va., has been chartered. J. Glenn Cook and others are the incorporators; capital stock, $100,000.

The New Orleans & Southern will erect a new roundhouse and a small machine shop at New Orleans, near Hancock street, as soon as the high water subsides.

J. J. Culbertson, Lee Buggett and W. B. Geary have chartered the Farmersville (Tex.) Cotton Oil Co., to erect a cottonseed-oil-mill. The capital stock is $30,000.

Girard Ohio, according to the local papers, offers a bonus of $25 000 and twelve acres of land for the removal there of the Coleman, Shields & Co.'s rolling-mill, of Niles.

The J. Matthews Boiler Works Co., of South Bend, Ind., will move their business to Harvey, Ill. They are now commencing to build their new works at this place.

Messrs. Burr & Bailey, operating foundry, machine shop and copper works at Wilmington, Del., have incorporated as the Burr & Bailey Co., with a capital stock of $60,000.

Church & Sleight, 109 Fulton street, New York, have received the agency for the sale of the lathes built by Sebastian Lathe Co., of Cincinnati, and have now a stock on hand.

The Fort Worth & Rio Grande Railway Co. (office, Fort Worth,) will erect machine shops in Brownwood, Texas, as soon as contract is let for extending the city water-works.

J. H. Horne & Sons Company, of Lawrence, Mass., have placed an order with the Berlin Iron Bridge Company, of East Berlin, Conn., for a new machine shop, 64x107 feet in size.

The Union Electric Company has been organized, at Louisville, Ky., to manufacture electrical and other instruments. John Welch is president, and J. M. Biggs, secretary and treasurer.

The Egan Company, Cincinnati, O., has recently received large orders for wood-working machinery from Lima and Arequipa, Peru. The company reports its foreign trade as being heavy.

The Magnolia (Miss.) Cotton-mills has been chartered to erect a cotton-mill. The incorporators are Wm. Atkinson, Henry E. Anderson, Wm. M. Wroten and others, and the capital stock is $100 000.

Milton Bellinger, of Ilion, N. Y., and L. F. Bellinger intend to establish extensive iron works in Tallapoosa, Ga. Machinery outfit for an extensive iron works plant will be purchased at once.

The Planters' Independent Oil Company will be organized, with a capital stock of $150,000, to erect a 120-ton cotton seed oil-mill and refinery at Little Rock, Ala. A. G. Riley can supply information.

The Branford Lock Works, of Branford, Conn., and the Yale Lock Co., of Stamford, Conn., have consolidated, and the latter company will take charge of the product of the Branford works at once.

The plant of the insolvent Deoxodized Metal Company, at Bridgeport, Conn., has been sold to F. W. Smith, one of the largest creditors, who will organize a new company to operate the works on a larger scale.

The county commissioners of Allegany County, Md., and Mineral County, W. Va., have decided to bridge the Potomac River somewhere in the vicinity of Bull Neck. The exact location will soon be determined.

The Central Bridge and Engineering Co., at Peterborough (Limited), has applied for incorporation, in Ontario, Can., for the purpose of manufacturing steel and iron bridges, and structural work; capital stock, $200,000.

The Domestic Sewing Machine Co. has entered into a contract by which it is to manufacture and sell the Williams Typewriter for the Williams Typewriter Co. It is intended to make fifty machines a day to begin with.

Plans are being prepared for the erection of a cotton weaving plant at Moundsville, W. Va; capital to be $35,000. The Moundsville Mining and Manufacturing Co. can give information when arrangements have been completed.

The Georgia Portable Electric Light and Power Company has been incorporated, at Atlanta, Ga., by A. C. Ticknor, H. C. Underwood, Thos. L. Bishop and others, to manufacture, own, buy, sell, etc., electric light and power apparatus.

The St. Augustine (Fla.) Bridge Company has been incorporated by W. W. Dewhurst, Matthew Hays, Allen Wood and others, to build, maintain and operate a toll bridge between St. Augustine and Anastasia Island. The capital stock is $50,000.

The shops of the New York, Susquehanna & Western Railroad will be moved from River Side to No. Paterson, N. J. The new plant and car shop will be 100x80 feet, and the machine 220x170 feet, and will be fitted with the latest improved machinery.

The Ranken and Fritsch Foundry and Machine Co., of St. Louis, Mo., have recently opened a branch office at 407 Rookery Building, Chicago, Ill., to introduce their new "Ranken-Fritsch" Corliss engine in the northern market. Mr. Charles P. Pollak is the Chicago manager.

The Occidental Bridge and Construction Company, of Kansas, Mo., has been incorporated, for the purpose of building bridges and other construction work. The directors of the company are: J. A. L. Waddell, Lee Treadwell, and others. The company is capitalized at $50,000.

It is possible that a company, backed by $250,000 capital, may be organized at Macon, Ga., to develop several fine water power sites on the Ocmulgee River. A meeting will probably be held at Macon on the 17th inst., at which many interested manufacturers and others will be present.

The Long Island Parlor Car and Sleeping Coach Co., of Portland, Me., has been formed, with capital stock of $100,000, for the manufacture of sleeping cars, and cars of all kinds. Benjamin Norton, of New York City, is president of the company, and Wm. J. Kelly, of Brooklyn, N. Y., is treasurer.

The New York, Susquehanna & Western Railroad Company have given contracts for eleven iron bridges to the Edgeman Bridge Company, of Wilmington, Del., which will be used to replace the present wooden structures between Pompton and Stroudsburgh. As fast as the bridges are received they will be placed in position.

The Jersey City & Bergen Railroad Company, of which Mr. C. B. Thurston is president, has just closed a contract with the Ball & Wood Company, of New York, for three cross-compound engines of 300 H. P. each. The intention of the company is to make the plant which will operate its lines a model one in its equipment and arrangement.

Machinists' Supplies and Iron.

NEW YORK, June 4, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15.75 to $16; No. 2, $14.75 to $15; Gray Forge, $13.75 to $14. Southern brands of good quality are obtainable at $15 to $15.50 for No. 1 Foundry; $14.25 to $15 for No. 2; and $13 to $13.50 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is easier for some brands. We quote Hallett's, 11¼c. to 11⅜c.; Cookson's, 14⅛c. to 14¾c.; and L. X., 13c. to 13⅛c.

Copper—The market for Lake Copper is quiet, with prices more or less nominal at 12c. for spot supplies. Casting Copper is held at 11.25c. to 11.40c.

Lead—Buyers are limiting their bids to 4.20c. for prompt delivery by the carload, and holders continue to quote 4.25c. There is apparent indifference on both sides.

Lard Oil—The market is quoted at 57c. to 58c. for Prime City. Western on spot is quoted at 56c. to 57c.

Spelter—The market is nominal at 4.85c. to 4.90c. There is no business.

Tin—Business is slow, but the market is well sustained by firm foreign advices. There are bids of 21.50c. for June and some business has been transacted at 21.75c.

BRADLEY HAMMERS

2000 IN USE.

FOR 20 YEARS these Hammers have been in the market and during all that time have been acknowledged the very best. The material we use and our method of construction are the result of ripe experience and not the jumped-at conclusions of amateurs. Send for circulars and price lists.

BRADLEY & COMPANY,
SYRACUSE, N. Y.

TO LET.

The Engine Works at Newburgh, N. Y., at present occupied by Wm. Wright, is offered to let from May 1st, 1892.

The Property consists of

MACHINE SHOP, FOUNDRY, BOILER, FORGE AND PATTERN SHOPS, with a full equipment of tools.

The works are located in the heart of the city, and convenient to railroad and river transportation.

For terms, apply to

HOMER RAMSDELL,
NEWBURGH, N. Y.

THE IRON FOUNDER

By SIMPSON BOLLAND, Esq.

300 Illustrations. 400 Pages. 12mo. Cloth, $2 50.

JOHN WILEY & SONS, - NEW YORK.

CLAMP DRILLS.

No. 1.—Weight, 30 lbs.,			Price, $15.
No. 2.— "	40 "	- -	" 20.
No. 3.—Geared,	40 "	- -	" 20.
No. 4.— "	50 "	- -	" 25.

Liberal Discount to the trade. Send for circular of full description. Also light-drilling machines for Hand and Power.

GEO. BURNHAM & CO., Worcester, Mass.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted — Position by mechanical draftsman. References. Address F. E., AMERICAN MACHINIST.

A young mechanical draftsman, tech. graduate, wishes a position. A. M., AMERICAN MACHINIST.

Wanted—A draftsman with some machine shop experience. Address Box 93, Albany, N. Y.

Wanted—A good mech. draftsman. Address, stating age, qualifications & salary. I. P., AM. MACH.

Foreman pattern maker, age, 31, thorough in all its branches, desires situation; best of references. Address Pattern Maker, AMERICAN MACHINIST.

Wanted—First-class pattern maker. Apply with refs. Sioux City Engine Works, Sioux City, Iowa.

Mechanical draftsman with 5 years' experience in steam engines and pump works wants permanent position. Address L. C. 333, AMERICAN MACHINIST.

Wanted—Situation by A1 blacksmith used to all kinds of machinery forging, tool dressing, etc. B., care AMERICAN MACHINIST.

Wanted—Several machinists familiar with repair work in a large jobbing shop in Western Indiana; give reference. J. A. P., AMERICAN MACHINIST.

Wanted—A situation as superintendent or foreman of boiler shop by a practical boiler maker; best reference. Address Boiler Maker, care AM. MACH.

Marine engineer, practical man, English, age 32, four years' sea exp., acquainted with latest designs marine mach'y, desires position. Tyne, AM. MACH.

Wanted—Position as supt. or foreman; successful in the systematic mfg. of machine tools, automatic & interchg'ble mach'y. H., Box 310, Florence, Mass.

Wanted—Position as foreman with concern m'f'g small interchangeable work; can design tools and labor saving devices. "No Slouch," AM. MACH.

Wanted—Position as foreman of machine shop or tool room; understands drawing and d signing tools for interchangeable work. Box 46, Simsbury, Conn.

Mech draftsman with thorough technical education and independent machine designer des. pos.; exp. in steam and pumping plants, printing press and special machinery. Box 12, AM. MACHINIST.

Wanted—Immediately, one draftsman; must have good technical education, and a good machine designer; also one pattern maker well up in general engine and machine patterns; state ages, exp. and salary expected. Kenney & Co., Scottdale, Pa.

Wanted—Three or four boys to learn the machinist's trade, not less than 17 years of age, and to have a fair common school education. Application must be made in own hand-writing. The Hendey Machine Company, Torrington, Conn.

The superintendent of an engine and boiler shop working 200 men, and owning patents of Corliss engines now being built, has $8,000 cash, 20 years' experience, desires an interest in a modern shop in the West. J. E. J., AMERICAN MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wall Drills complete, $25. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

Presses, Wire Form'g Mchy. Am. Tool Wks, Clev. O.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

MOFFET PORTABLE DRILL.

UNSURPASSED AS A **REAMER.**

Weighs 42 lbs. and drills from ⅜ to 1¼ inches diameter.

Runs with Steam —OR— Compressed Air.

Will work in any position.

Send for Circular.

Manufactured by **J. G. TIMOLAT,** 59 S. Fifth Ave., NEW YORK.

Assignee's Sale. Manufacturing Plant.

DULUTH, MINN.

All the land, buildings, fixtures machinery, tools, patterns, patents and property of IRON BAY COMPANY will be sold by the assignee on very favorable terms.

Plant is at West Duluth. Main buildings are brick with slate roof, and fixtures and machinery cost $75 000 two years ago. Buildings at present value, land at cost and the machinery and fixtures attached and forming a part of the real estate inventory $125,000. The unattached machinery, tools, unmanufactured material and patterns at a very low estimate aggregate $73 000. This plant is especially equipped for the manufacture of various forms of **BOILERS, ENGINES, SAW MILL** and **MINING MACHINERY**, and **FOUNDRY WORK OF ALL KINDS**, and is in condition to be run at any time, having been shut down since the 1st of May, 1892. **UNEXCELLED SHIPPING FACILITIES; RAIL OR BOAT.**

Sealed bids for this property as a whole, or separately for the land, buildings and machinery attached as one parcel, and for whole or any part of balance, will be received up to noon, July 1st, 1892. SEND FOR DESCRIPTIVE CIRCULAR AND TERMS OF SALE.

The right to reject any and all bids is reserved.

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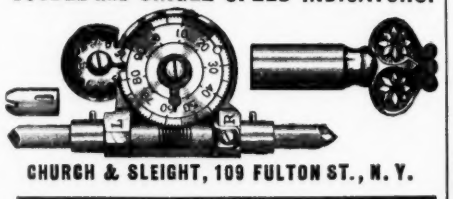

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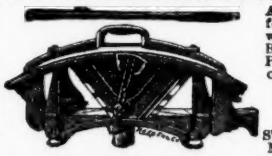

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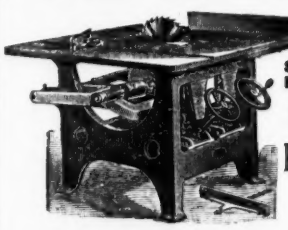

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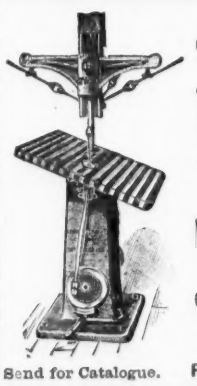

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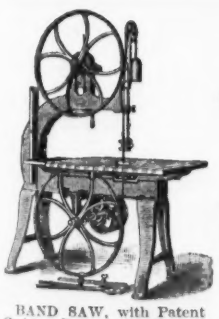

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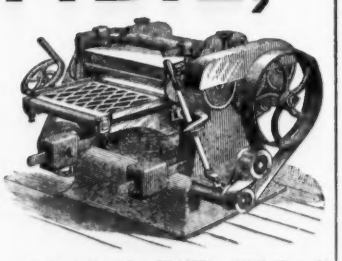

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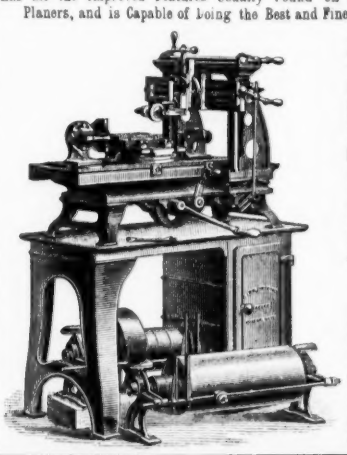

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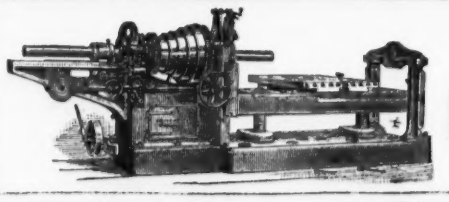

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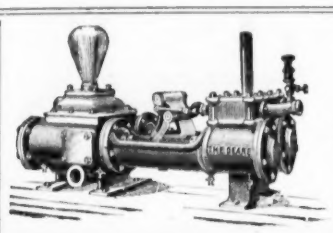

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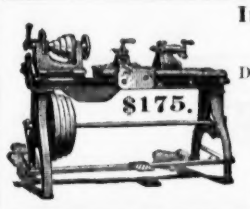

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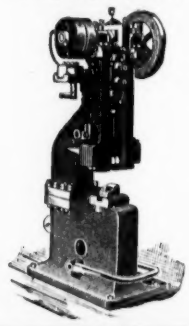

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24 do	12 do	do			Fitchburg
24 do	12 do	do			Flather
23 do	10 do	New Pattern			Fifield
23 do	12 do	do			do
22 do	12 do	New			Blaisdell
22 do	8 do	do			Flather
22 do	10 do	do			do
20 do	8 do	do			do
20 do	10 do	do			do
18 do	8 do	do			do
18 do	10 do	do			do
18 do	8 do	do			Blaisdell
18 do	16 do	do			do
16 do	6 do	do			Flather
16 do	6 do	do			Blaisdell
15 do	6 do	do			Flather
14 do	6 do	do			do
14 do	6 do	do			Blaisdell
12 do	6 do	do			do

PLANERS.

42 in. wide, 42 in. high,	12 ft. long,	2 heads		Gleason
36 do	36 do	8 do		Pease
30 do	30 do	8 do		do
30 do	30 do	8 do		Whitcomb
30 do	30 do	8 do		Flather
26 do	26 do	6 do		do
24 do	24 do	6 do		do
24 do	24 do	6 do		Whitcomb
22 do	22 do	5 do		do
22 do	22 do	6 do		Flather

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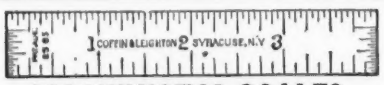

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54 in. x 42 in. x 24½ ft.	do	2 do			
46 in. x 33 in. x 30 ft.	do	2 do			
42 in. x 41 in. x 8 ft.	do	1 do			
39 in. x 36 in. x 12 ft.	do	1 do			
36 in. x 36 in. x 10 ft.	do	1 do			
30 in. x 30 in. x 7 & 8 ft.	do	1 do			
26 in. x 26 in. x 6 ft.	do	1 do			
25 in. x 24 in. x 6 ft.	do	1 do			
22 in. x 21 in. x 5 ft.	do	1 do			
96 in. Raising Blocks to 13 ft. x 26 ft. Bed Engine Lathe.					
50 in. x 30 ft. Bed Triple Geared.			New	do	do
48 in. x 22 ft. do			do	do	do
42 in. x 17 ft. do			Al	do	do
32 in. x 12, 14, 16, 18 ft. Bed.			New	do	do
28 in. x 12, 14, 16, 18 ft.		do	do	do	do
24 in. x 10, 12 ft.		do	do	do	do
20 in. x 7½ & 8 ft.		do	2d Hand	do	do
18 in. x 6, 7 & 8 ft.		do	New & do	do	do
17 in. x 8 ft.		do	do	do	do
16 in. x 6 & 8 ft.		do do	do	do	do
15 in. x 6 & 8 ft.		do do	do	do	do
14 in. x 6 ft.		do do	do	do	do

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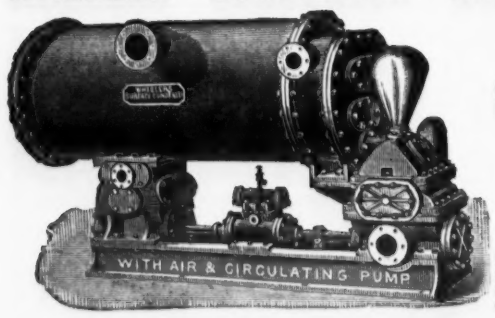

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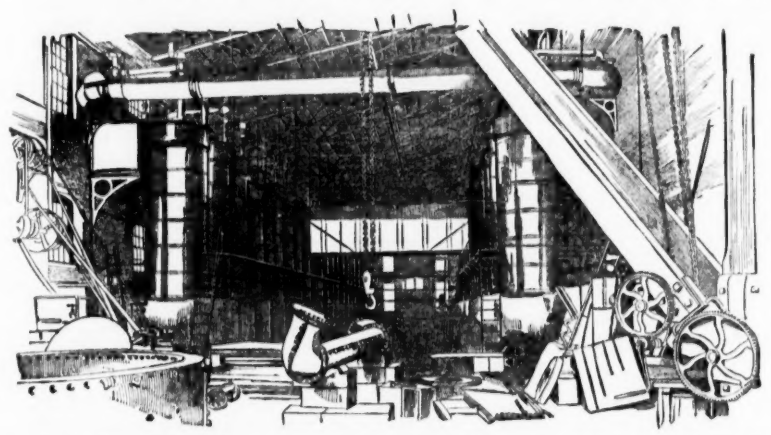

The above illustration is taken direct from a photograph, and shows the interior of a Boiler House, the roof of which was designed and built by us for The Amoskeag Mfg. Co., at Manchester, N. H. The building is 75 ft. in width by 275 ft. in length, the walls being made of brick, and the roof being made of iron—iron trusses, iron purlins, and covered with corrugated iron, so that there is absolutely no woodwork anywhere about the building which can take fire. For Boiler Rooms this construction particularly commends itself.

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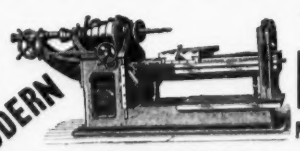

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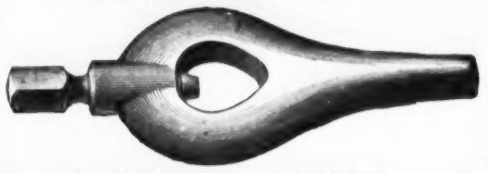

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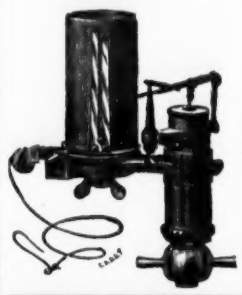

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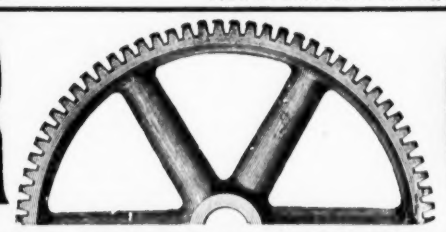
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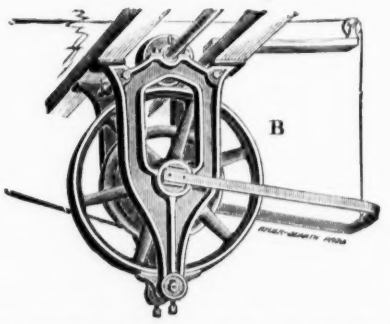

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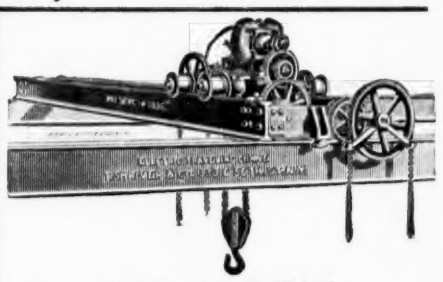

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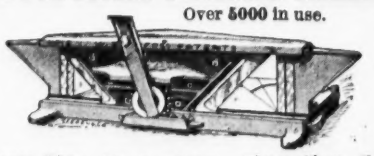

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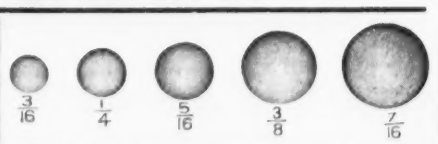

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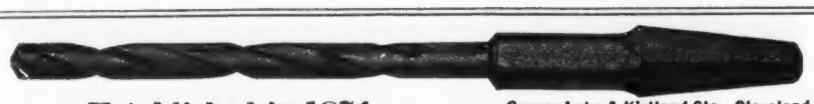

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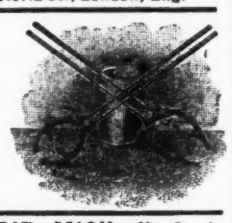

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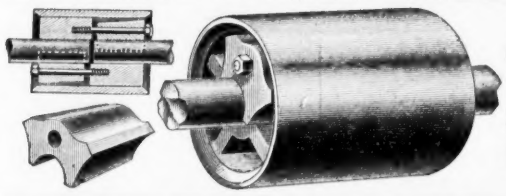

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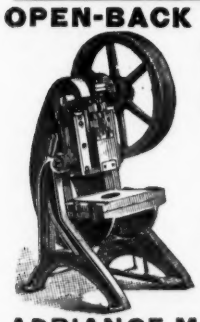

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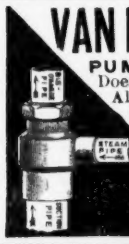

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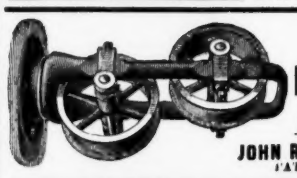

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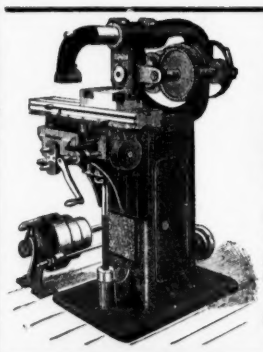

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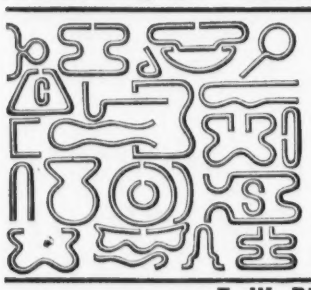

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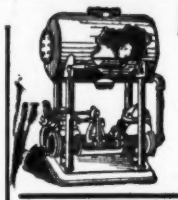

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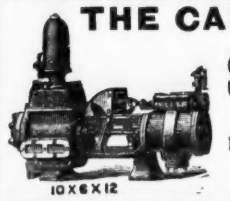

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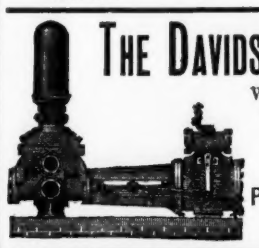

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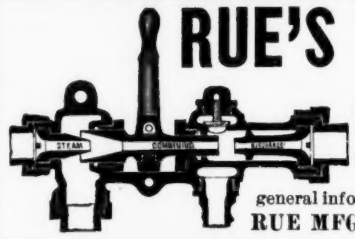

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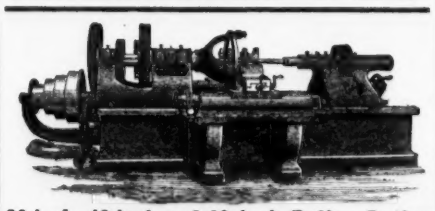

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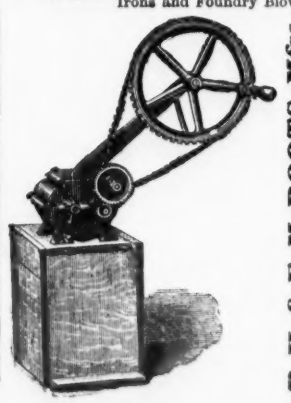

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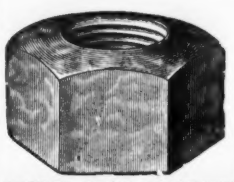

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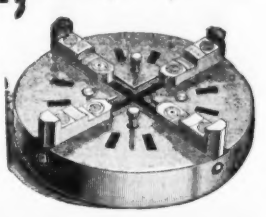

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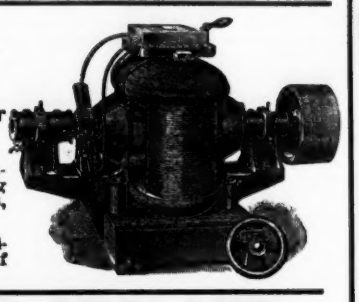

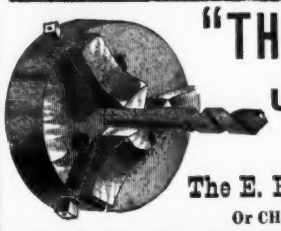

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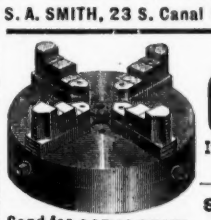

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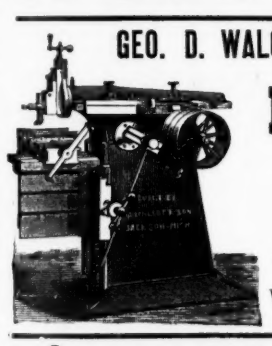

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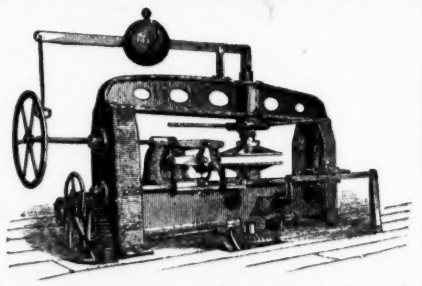

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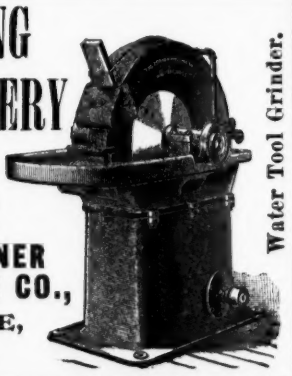

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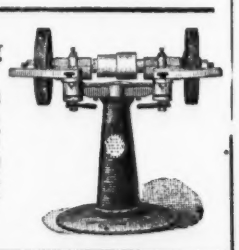

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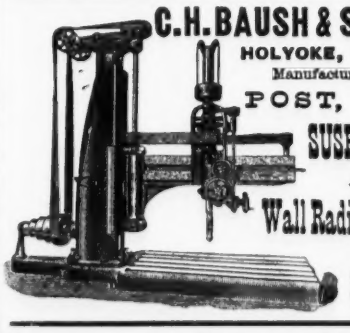

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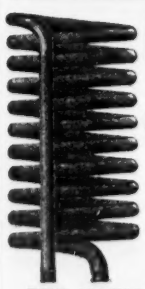

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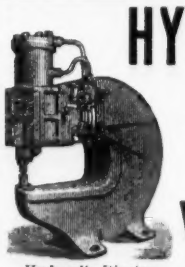

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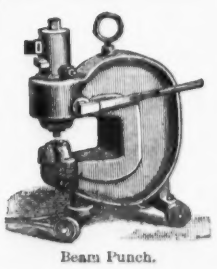

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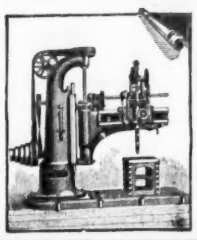

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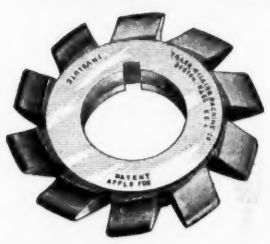

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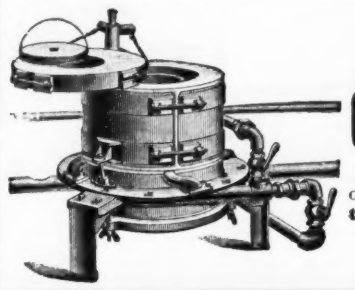

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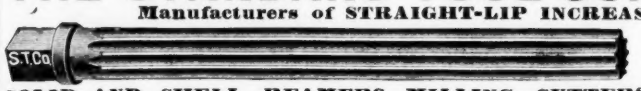

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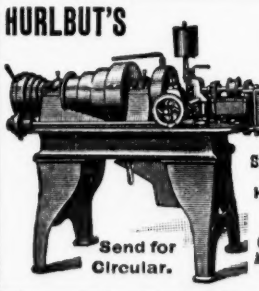

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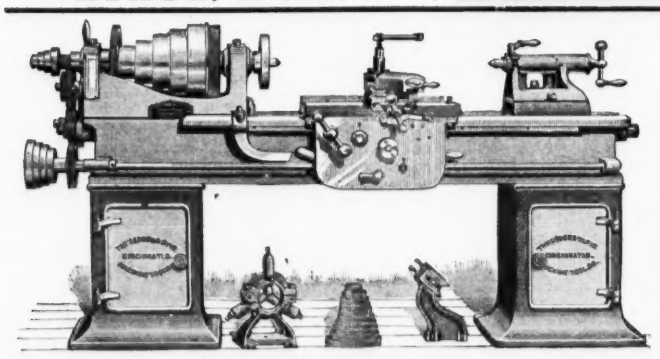

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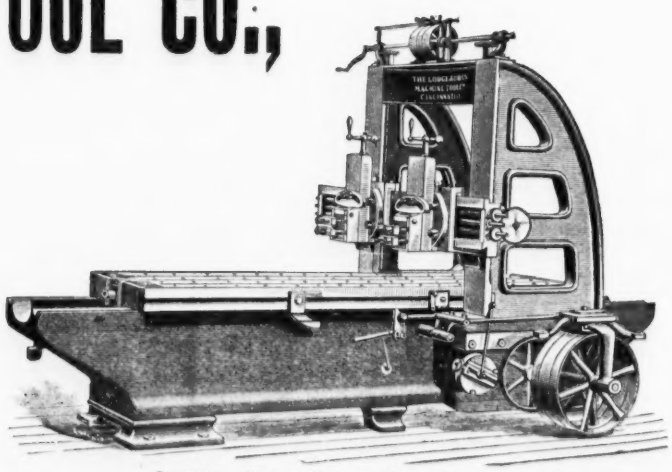

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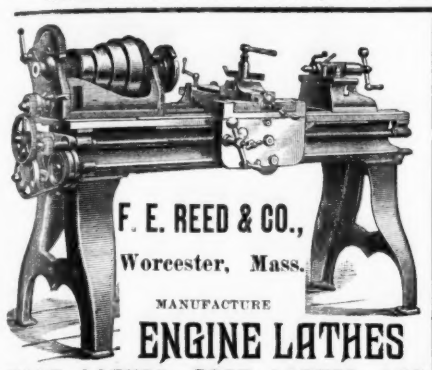

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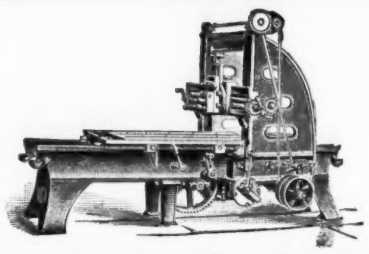

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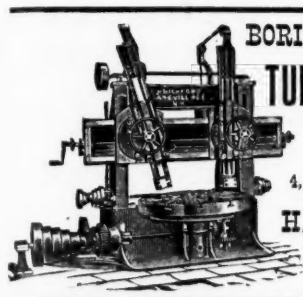

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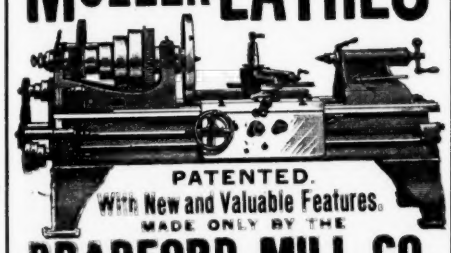

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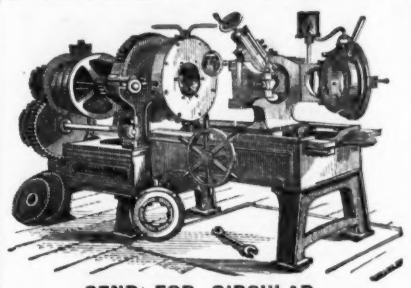

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For Pipe, Mill and Steam Fitters' Use.
TAPPING MACHINES,
For Steam Fitting, also
Steam and Gas Fitters' Hand Tools.
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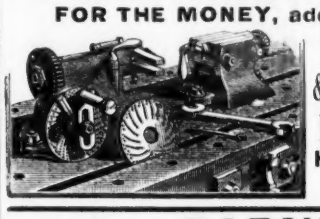

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Complete line, ranging from our New Friction Disk Drill, for light work to 42-inch Back Geared Self Feed Drill.
Send for Catalogue and Prices.
W. F. & JOHN BARNES CO.,
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FOX & TURRET LATHES A SPECIALTY.
MANUFACTURERS OF
MACHINE TOOLS,
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OUR SPECIALTY
CRANK and GEARED SHAPERS.
J. STEPTOE & CO., Cincinnati, O.
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Lathes from 10 in. to 20 in. swing. Largest Variety of Drills manufactured in the world.
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MANUFACTURERS OF
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TOOLS AND MACHINERY.
BRASS FOUNDERS
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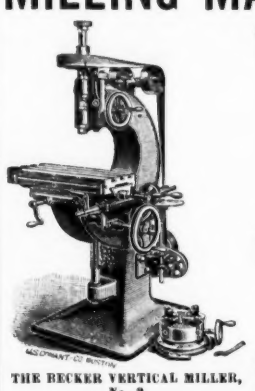

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Price $10
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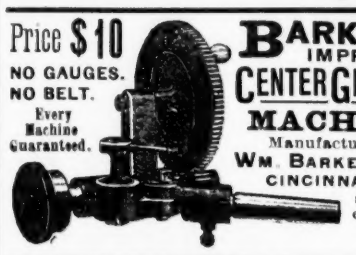

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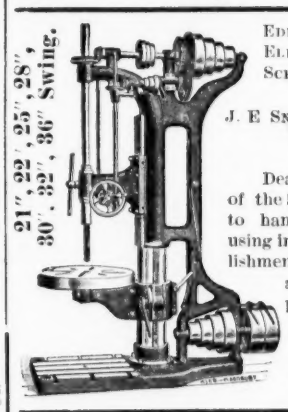
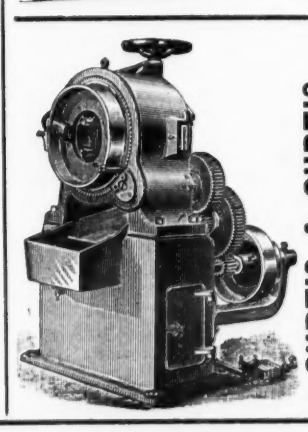


EDISON GENERAL ELECTRIC COMPANY,
SCHENECTADY, N. Y.,
Jan. 12, 1891.
J. E SNYDER, Esq.,
17 Hermon St.,
Worcester, Mass
Dear Sir:—Your letter of the 5th inst. came duly to hand. We are now using in our various establishments 60 of your drills, and are very well pleased with them.
Yours very truly,
JOHN KRUESI,
General Manager



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Pipe Cutting and Threading Machinery,
FOR HAND OR POWER.
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES.

WE ARE OPEN TO CONTRACT
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FINE MACHINE WORK.

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SEND FOR OUR NEW CATALOGUE.
Having added a Blacksmith Shop containing a 350 lb. Steam Hammer to our already extensive plant, we are now prepared to estimate on forgings of all kinds. We carry a full line of Milling Cutters in stock.

We make Angle Milling Cutters
JOB WORK DESIRED.
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The "Simplex" Glass-Tube Cutter.
This simple little instrument will be found quite as effective in its operation as any one of the numerous Glass-Tube Cutters costing five times its price. Its trifling price places it within the reach of every one who has use for such a tool.

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DO NOT SEND US ANY POSTAGE STAMPS.
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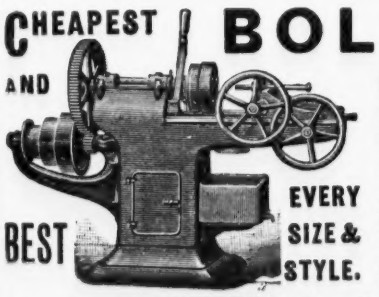

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SEE THAT
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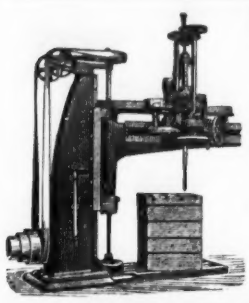
is on every STEAM REGULATING VALVE that you buy, then you get the best.



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Operated by Electricity, Shafts or Independent Engines.
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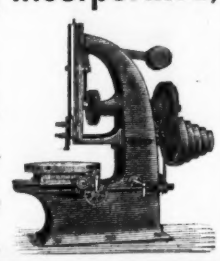

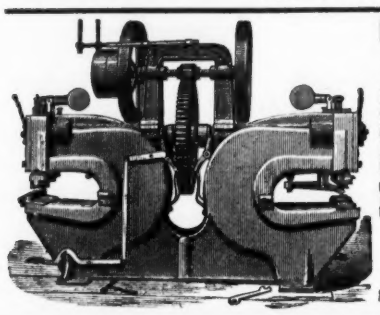

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Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven
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OVER 300 SIZES.
ALSO
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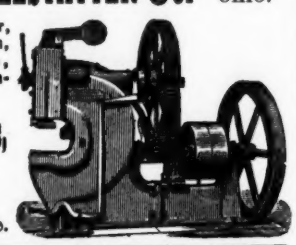

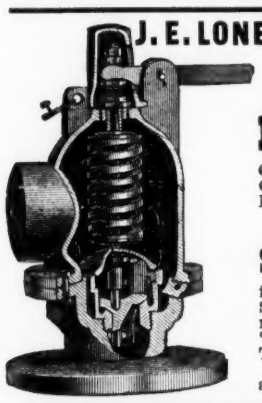

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for Locomotive, Stationary and Marine Boilers, also the "Reliable" Steam Trap.
Catalogue free on application.

ROBERT POOLE & SON CO.,
TRANSMISSION and SPECIAL
MACHINERY,
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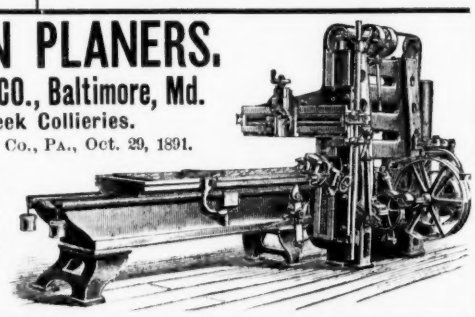
GEARING,
FACILITIES FOR
HEAVIEST CLASS OF WORK,
BALTIMORE, MD., U. S. A.

THE OPEN SIDE IRON PLANERS.
THE DETRICK & HARVEY MACHINE CO., Baltimore, Md.
COXE BROS. & CO., Cross Creek Collieries.
DRIFTON, LUZERNE CO., PA., Oct. 29, 1891.
GENTLEMEN: In reply to yours 27th inst. would say that the Open Side Planer purchased from you has given entire satisfaction in every particular, and consider it one of the best planers we have in the shop. We have used it in different classes of our breaker machinery, and can cheerfully recommend it to any one requiring tools of this kind. Yours truly,
COXE BROS. & CO.,
JOHN ROHLAND, Supt. Machine Department.



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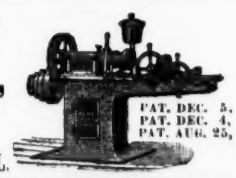
Cutting from 1-8 in. to 6 in. diameter.
Also SEPARATE HEADS and DIES.
FIRST PREMIUM, CINCINNATI CENTENNIAL.



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THE D. FRISBIE CO.,
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MACHINERY For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
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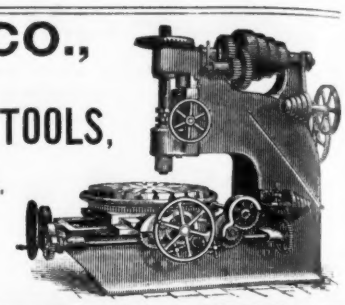
NEW YORK OFFICE, EQUITABLE BUILDING.
GEORGE PLACE, Agent.



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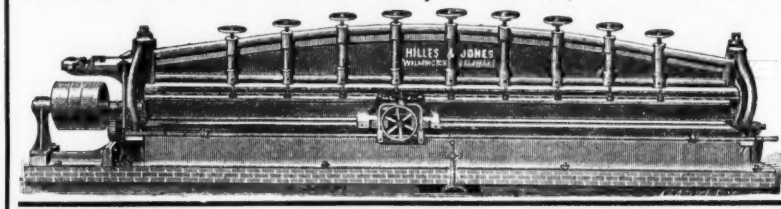

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Eight Sizes.
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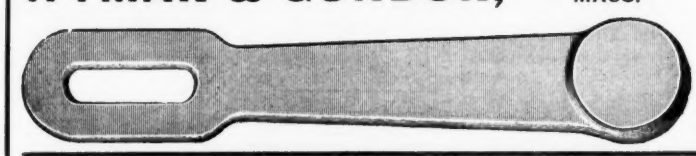

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60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel now running prove this.
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STEEL CASTINGS of every description.
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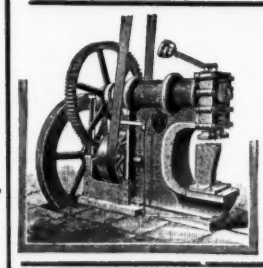
Works, Chester, Pa. Office 407 Library St., Philadelphia, Pa.



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ESPECIALLY ADAPTABLE FOR
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HETHERINGTON & BERNER,
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THE ERIE KEY-SEATING MACHINE.
MANUFACTURED BY
THE BURTON MACHINE CO.,
302 Peach St., Erie, Pa., U. S. A.

OIL WELL SUPPLY CO., LTD.
OIL CITY, PA., Oct 25, 1890.
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GENTLEMEN:—Replying to your recent favor, asking how we liked the Erie Key-seating Machine, would say it has proven very satisfactory and we think has done even more than you guaranteed it to do. It would be difficult to find a better machine for our work.
Respectfully yours,
OIL WELL SUPPLY CO., Ltd.
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GIANT KEY SEATER.
Rack-Cutting Attachment
Key-Making Machines
VALLEY MACHINE CO.,
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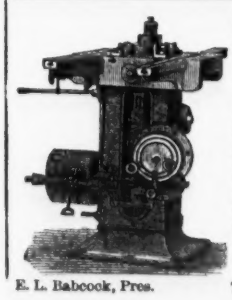

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E. L. Babcock, Pres. The Falls Rivet & Machine Co.

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THE LEADER.
With recent patented improvements, we guarantee to do the following class of work.
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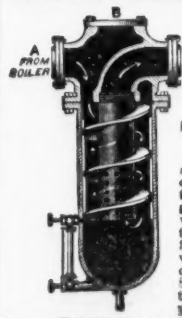
For particulars address THE MORTON M'F'G CO., MUSKEGON HEIGHTS, MICH.



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Simpson's Centrifugal Steam Separator.
For Supplying Clean and Dry Steam to Engines, Dry Houses, etc.
Place Separator as close to engine as possible, the steam taking a spiral course between the threads causes the water to be thrown by centrifugal force against the outer walls, while the dry steam goes through the small holes to center of pipe. Steam can enter at A or B, as convenience may require; also used in conveying steam long distances, for Steam Hammers, Dry Houses, Water Gas Generators, and for all purposes where Dry Steam is necessary.
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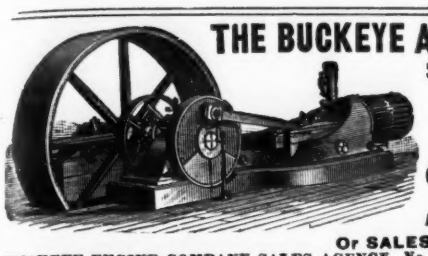

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Complete Steam Power Plants of Highest Attainable Efficiency.

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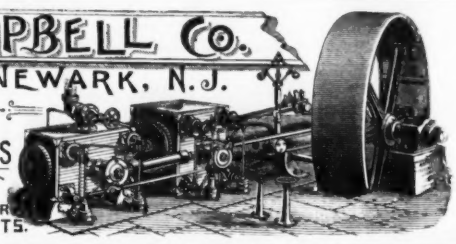

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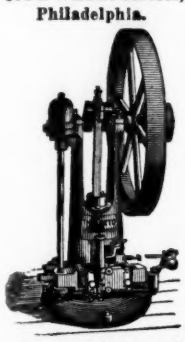

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Consume 25 to 75 Per Cent. Less Gas than ANY other Gas Engine doing the same work.

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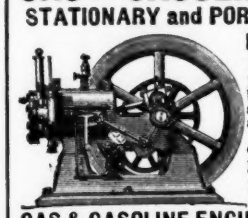

Dwarfs in Size, but Giants in Strength.

Expense one cent an hour per horse power and requires but little attention to run them.

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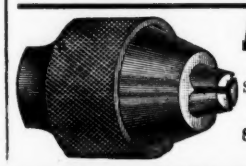

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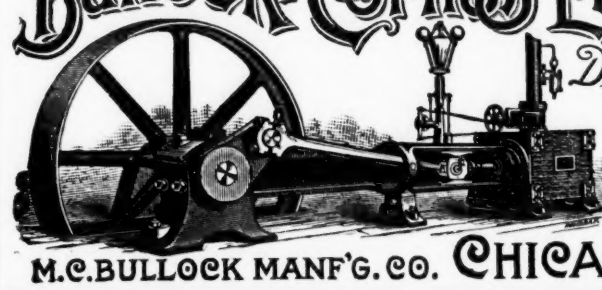

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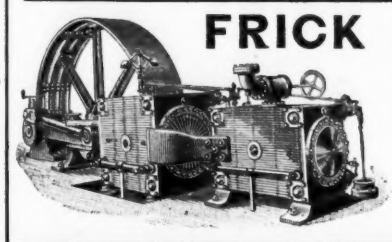

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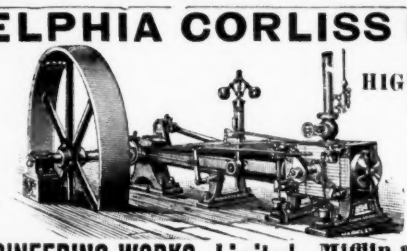

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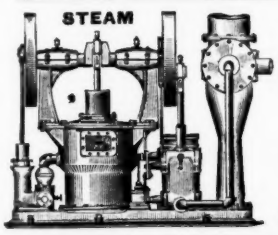
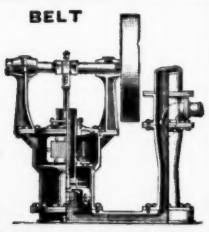


BELT



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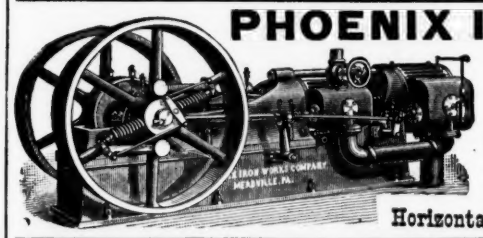

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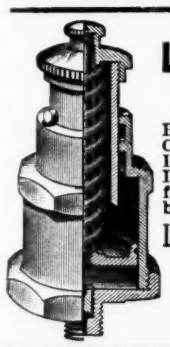

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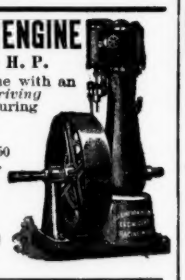

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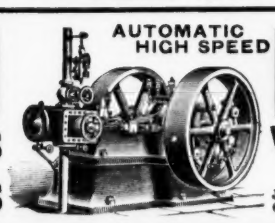

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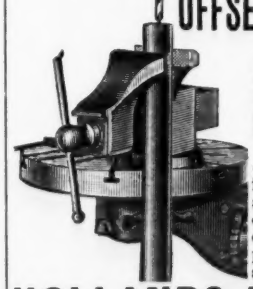

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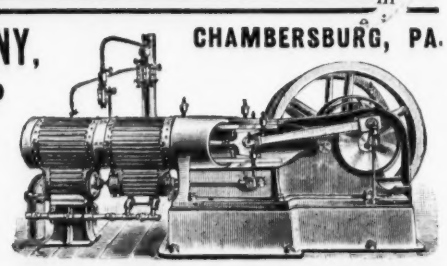

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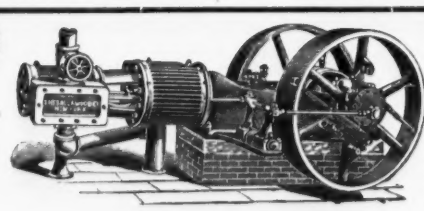

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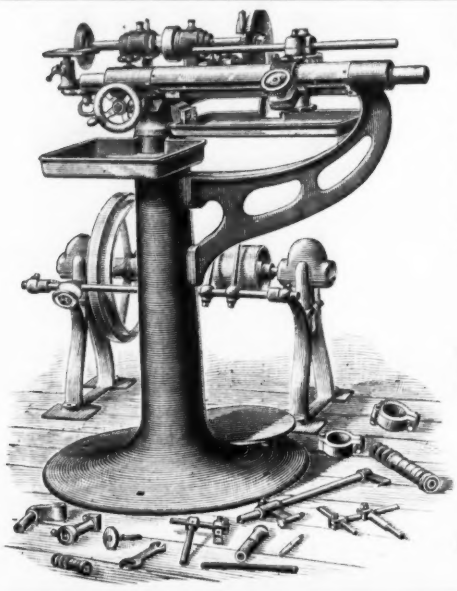

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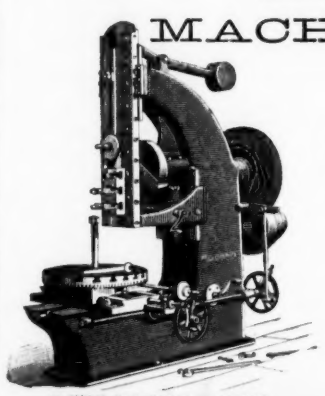

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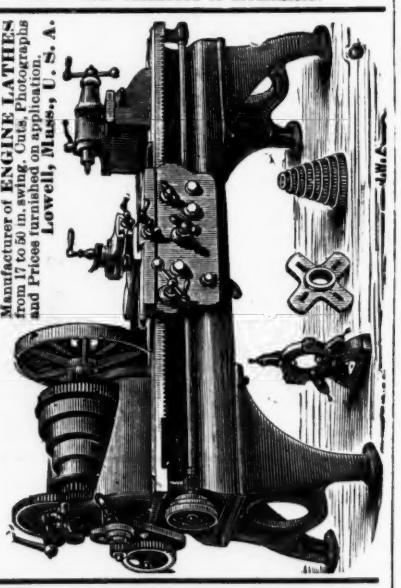

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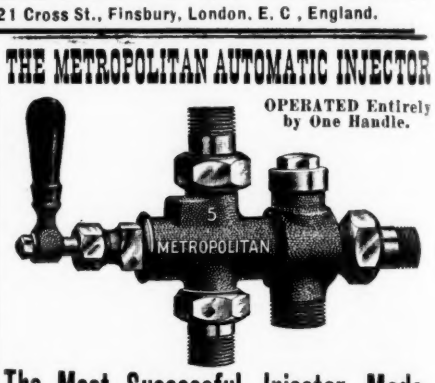

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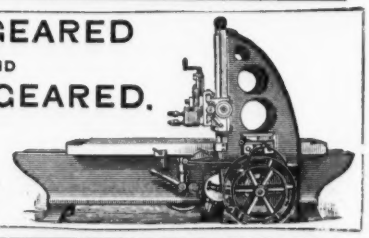

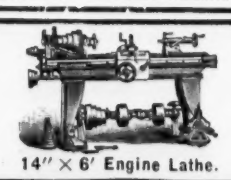

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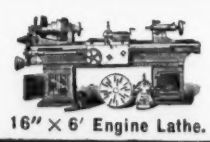

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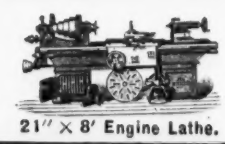

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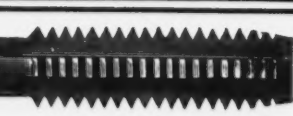

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